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Coke and Coal in Melting Iron.

BY THOS. D. WEST.

There having been recently so many encomiums upon the merits of coke for melting iron, and none for coal, it seems to me that some, through short acquaintance with coke, are a little too enthusiastic to show up one good fuel at the expense of another. I do not deny that coke is a good fuel to melt with, if its use is understood; nevertheless, coal is also good, and in some ways superior, for which I would not like to see its use abandoned. Before I get through, I hope to show wherein the merits of each fuel lie, and to present a few ideas that may assist those wishing to change from coal to coke.

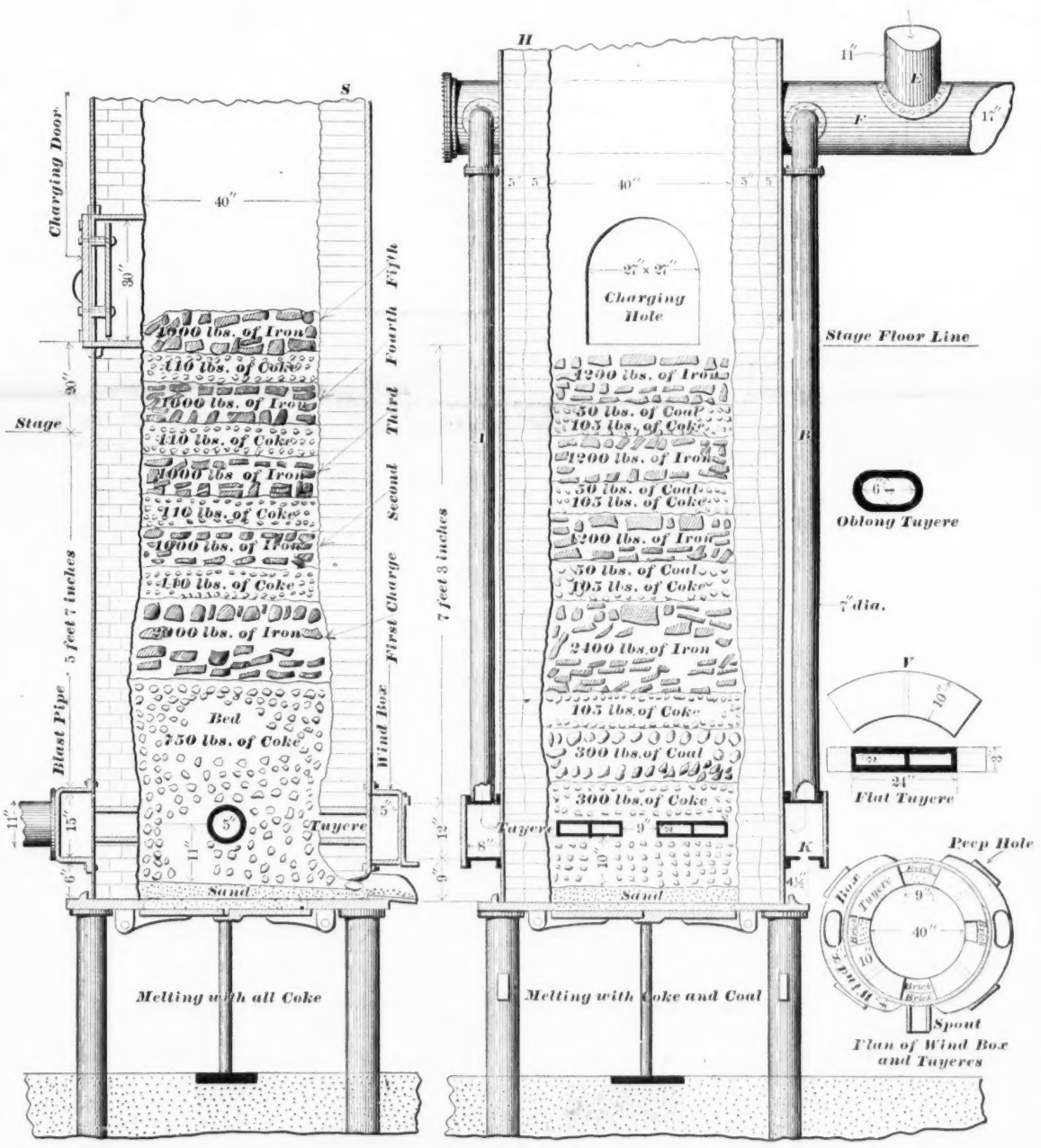
The merits claimed for coke are as follows: First, that it will melt faster than coal; second, that it requires less blast pressure; third, that it is a cheaper fuel than coal; and fourth, that it contains less impurities, and will make softer castings. The first three are certainly true, but regarding the fourth I have doubts, and am afraid it would not stand a rigid test.

Either through design or lack of observation, there seem to be two important points in the use of coke and coal that have not beenbrought out. One is regarding the life and heat of the metal, and the other the length of heats. The foundrymen in this section of the country have had experience with coke for a long time, and I have yet to hear any of them say that coke, on an average, is better than coal for making hot metal, for length of heats, or for soft castings. To run long heats, and have metal keep its life, is a very important factor with many foundries; such, for instance, as those doing heavy work, where the first five or ten tons melted have to stand in a ladle from one to two hours, waiting for another ladle to be filled. There is a notable feature—that of the life of liquid iron—that many shops may not notice, as with them the metal may be said to be no sooner out of the cupola than it is poured into the moulds. I am a firm believer in melting iron as hot as possible, as I know it to be a fact that stronger castings can be made by so doing.

The length of heats has in my practice been increased by using coal with coke, and in this section many foundries mix coal with coke, in order to do clean cupola work and produce hot iron. That a cupola will run longer with a mixture of Lehigh coal and coke is admitted by Cleveland foundrymen to be a fact.

In order to make my subject plain, and to show ways of charging, the accompanying cuts are inserted. The cupolas, as shown, are charged for ordinary heats. To run at their full capacity, about ten pounds more fuel should be added to each charge.

To commence with, I will state that the description of the various modes of melting here given are not test heats got up to show how fast melting can be done, or to present the two-sided question of economy in fuel.



METHOD OF CHARGING FOUNDRY CUPOLAS.

The heats described are the average *practical* workings of a few common, plain, round cupolas in this city. The Cuyahoga, Viaduct, Eclipse, and Globe Works have kindly allowed me to publish their ways of melting.

The Cuyahoga and Globe Works make heavy steam engine and machinery castings. The Eclipse do a large business in housework and general jobbing castings; while the Viaduct Works make a specialty of vapor oil stoves and light jobbing castings. These four specialties cover about all ordinary foundry practice, so that nearly all can apply one or the other to their own practice.

The Cuyahoga and Globe Works each have two cupolas, and their smallest ones being of about the same size, I have chosen them to show their practice of using coke and coal. The Globe Works' cupola is charged with all coke; the Cuyahoga with coke and coal. The charges, as shown, are continued to the end of the cupola's capacity. The Globe Works' blast pressure is five ounces, obtained from a Sturtevant No. 8 fan. Time of melting, when using all coke, three tons per hour.

The Cuyahoga's blast pressure is seven ounces, obtained from a Root rotary blower No. 5. Time of melting, with coal and coke, three tons per hour.

The Eclipse Works' mode of charging, with all coke, for a heat of seven tons is: 700 pounds of coke for the bed and 1,200 pounds of iron for the first charge, the balance of iron charges being all 800 pounds. Between the charges, 95 pounds of coke. The cupola is 35″ inside diameter, having four round 5″ tuyeres, about 18″ from the sand-bed to center. The height of charging doors, bottom to foundation plate, is nine feet; blast pressure seven ounces, obtained from a No. 7 Sturtevant fan. Time of melting, 6,500 pounds per hour.

The Viaduct Works' mode of charging, with coal and coke, for a heat of six tons is: 738 pounds of coke and 400 pounds of coal for the bed; first charge of iron, 1,800 pounds. The balance of iron charges, 1,200 pounds; fuel between them, 123 pounds of coke and 25 pounds of coal. The cupola is 38″ inside diameter, and has our oblong tuyeres of the dimensions shown, their height from sand boottm being about 16″. The height of charging door from plate is eleven feet; blast pressure twelve ounces, No. 5 Sturtevant fan. Time of melting, 6,500 pounds per hour. As a general thing, in the charging of this cupola there is not any fuel used between the last charges.

For a flux this firm and the Cuyahoga Works use fluor spar. I find it a good thing for cleanliness of metal and cupola. In using this flux, we shovel about 12 pounds on the top of each charge, with the exception of the first two o three charges. The cost of this flux is about $12 per ton, delivered.

In melting with coke the fire does not require to be started as early, simply because coke does not require as long a time to kindle as coal. The idea of time for kindling should be to allow sufficient to have the fuel all on fire before iron is charged. Any longer than this is only a waste of fuel, and a detriment to successful melting. The draft, and kinds of kindling used, should govern the time of starting fires. The bed, when all coke, should be from 6″ to 10″ higher than where coal is used. The charges of iron should not average much over one half the weight of the charges when coal is used; or, in plainer language, where a charge consists of 2,400 pounds of iron with all coal, with all coke it should be about 1,400 pounds. As successful melting with coke cannot be done with low tuyeres as with coal. As a general thing, coke melting requires tuyeres to be from 18″ up to 30″ above the bottom plate, or about one-third higher than for coal. I do not mean by this that coke melting cannot be done with low tuyeres, but that with high tuyeres longer heats and hotter iron will be obtained. My theory for this is based upon the proposition that a Lehigh coal fire has more of a body than a coke fire. The blast as it goes into a cupola will more readily cool off coke than coal, and this cooled body of fuel, if not attended to, gradually increases until it reaches nearly to the center, which results in scaffolding or bunging up the cupola. To

assist in preventing such results the blast should occasionally be slackened, the tuyere peep holes opened, and then with a bar, the cooled body of coke, and frozen drop pings of metal should be driven in towards the center of the fire. This will cause the cooled body to be rekindled, the frozen droppings remelted, and give a clean hot body of fuel for the cold blast to play upon.

My experience and observation of coal and coke has satisfied me that coke will create, as a rule, more slag than coal.

I recall here a case where all coke being the fuel the tuyeres had to be raised in order to successfully melt the required amount of iron. The shop in which this occurred was the Cleveland rolling mill company's foundry, Newburgh, Ohio. Working there at that time, I carefully noted the results of the change. The size of cupola was 44 inches inside diameter; charging door 8 feet 6 inches from the bottom plate. The tuyeres were originally about 20″ high, and by the time fourteen tons of iron were melted the bottom had generally to be dropped. This became a nuisance, as the shop would often be left with moulds unpoured. The tuyeres were finally raised to 30″ high and altered from a flat tuyere similar to one shown in right-hand cut, to six 5″ round tuyeres. With these changes the cupola would successfully melt twenty tons.

In melting for machines, or heavy casting, the iron is generally allowed to accumulate before tapping out. This accumulation causes the raising and lowering of fuel, thereby not leaving any body long at a time exposed to the cooling effects of the cold blast. The benefit of this cannot but be seen if connected with the reason for slackening the blast and barring a cupola, as noted.

A point that has much to do with ill success in changing from coke to coal, is using too strong a blast. As a general thing one-third less pressure at least should be used for coke than for coal. I know it is nice to see a cupola melt fast, but not so enchanting to have to reline it about every two months, which will often result from too strong a blast.

It is impossible to obtain good soft castings where a cupola is being cut to pieces with the blast. The cupola on the right ran for about one year, almost daily, without being relined, which will, I think, be acknowledged as a good showing. I do not credit all to the merits of a mild blast. There is another feature that undoubtedly had much to do with it; that is the daubing up of the cupola with fire clay. I know that many object to the use of fire-clay, on account of its expense. This is I think where they are in error. If the users of common clay would give fire clay a trial for about six months, using it as daubing should be used, I think that at the end of the trial, if the extra expense is balanced against bad castings, through dull and dirty iron, slow melting, through accumulation of slag, time and labor lost in picking out cupolas and the cost of fire-brick and clay in relining what should not be required to be relined for six months to come, the fire-clay would be found far the cheapest in the end.

The melting of iron is a subject I have written a great deal upon, and there are other points that might here be mentioned, but as I decline to republish my views, I will close by saying that in both of our foundry cupolas we constantly use coal and Connellsville coke, as shown, and by proper attention to slagging (which I am sorry to say has to be done through the tapping hole because of not having a good chance to place a regular slag hole). Our cupolas will run for hours and then drop as clean as if they had only been in blast for one hour.

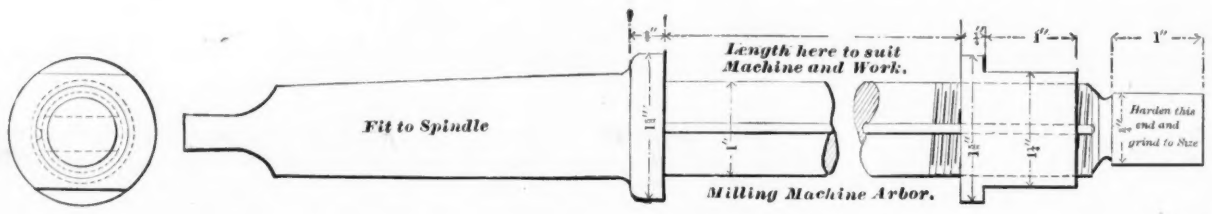
The smallest cupola, which is here shown, has been kept in blast from one o'clock, P. M., until 7:30, P. M., and then dropped clean. In fact, I have yet to see such a thing as scaffolding or cupola bunging. Such a commendable report I would like to see presented from the use of all coke in any similar common style and sized cupola.

The Milling Machine—Its Construction and Uses.

THIRD PAPER.

By JOHN J. GRANT.

In my last I promised a sketch of a modern milling machine arbor. The accompanying drawing, with the instructions given in the last article, will enable any first-class workman to make this tool. [The engraving is made half size of drawing.] It will be noticed that there is a groove running the entire length of the straight part of the arbor. This should be made half round, and of about $\frac{1}{8}$″ diameter. The cutters should also be splined in same manner. A wire key can then be used. This is much handier than putting in a square key, as a box with various lengths of wire can be kept to accommodate different thicknesses of cutters.



The practice of square spline should not be countenanced, as there is greater liability to crack the cutters during the process of hardening, and also when at work, owing to the square corners. All milling machines have a constitutional tendency to jar, or *chatter*, in machine shop vernacular. This evil is overcome in a great measure by cutting the teeth of the milling cutters spiral. The angle of spiral best suited for different kinds of work can only be accurately determined by experiment; but a safe rule to use for general work is one turn in 25 to 36 inches. In gang or multiple cutters, especially those milling wide surfaces, the spiral should be cut both right and left-hand. This will be found to materially lessen the chatter. In either single or gang cutters, if one side of the cutters are used to cut on the face, such as squaring nuts or similar work, the side of the cutter having the most acute angle caused by cutting the milling cutter spiral should be used. Cutters for splining or milling slots should not be cut spiral unless they are over one inch in width. Better results can be obtained by making cutters for such purposes in two pieces. They can then be cut with right and left-hand spirals, and locked together in the center. This way of making allows an adjustment as the cutters wear. I will, with another article, give drawings of cutters made in this manner.

The angle of the cutter used for making the cutter varies with the kind and diameter of the cutter being made, those of a larger diameter requiring a lesser angle than the small ones. A cutter of about 35° is best suited for general sizes of mills.

Face or end milling is growing in favor, and I think, with properly-constructed tools, the time is not far distant when it will supersede the general way of milling surfaces. In many cases where the machine is rigid enough, and the work is of such a character that extreme accuracy is not required, the cutter can be so constructed that it will take both a roughing and finishing cut at the same operation. I have seen work done with this style of cutter that would stand a very fair test on a surface plate. I have a hexagon nut in my possession that was milled in this manner, and it is hardly possible to see the marks of the cutter. These nuts are case-hardened direct from the milling tools, and not one person in ten can tell the difference between the milled or polished ones. Various kinds of cutters used for this style of milling will be shown by cuts in the articles to follow.

The arbor for face mills as a general thing is made with a large shoulder and either a right or left-hand thread, according to the way the machine runs. This thread is cut close to the shoulder, and the cutters are screwed on, it, of course, being impossible to have any nut at the outer face.

Machines made to use face mills should have hollow spindles and a screw passing through the entire length and screwing into the rear end of the arbor. This will prevent the cutter from working out of its taper socket. This way of fastening would be an improvement over the old style of mortised slot through the spindle of any milling machine. The arbor could be taken out as quickly as with the hammer and key, and the workman could be assured that it would remain there until taken out.

To produce accurate work it is necessary to keep the cutters sharp and in perfect order, which can be done only by having a cutter-grinding machine, and I have never yet seen one on the market that completely fills the bill. It is not difficult to construct a grinding machine that will grind nearly every shape of cutter used to perfect gauge. Here again comes in the penny wise and pound foolishness of a good many who use milling machines. With excellent milling machines and cutters, they will use some old rattletrap that is concocted in the shop sooner than pay one hundred and fifty or two hundred dollars for a machine that is built for the purpose. Some manufacturers of cutter grinders make them double-ended on the spindle, using one end for grinding shop tools. This is very bad economy, as the result will be that both wheels will be used for that purpose. The wheels will get out of balance, when it will become impossible to grind a cutter without leaving ridges across the face. The wheel for regular grinding—that is, for common milling cutters—should be about two or two and one-half inches in diameter, five-sixteenths of an inch thick, and of No. 70 emery. The number of emery will vary a little with each make of wheel. If the wheel and machine are used for no other purpose than grinding cutters, the wheel will remain perfectly true, and in no other condition can it do cutter grinding properly.

Pumping Engine Test.

We condense from the Fall River *Evening Daily News* the following with reference to the pumping engine recently erected in that city by the Davidson Steam Pump Company, of Brooklyn, N. Y.:

The pumping machine consists of two double outside plunger compound condensing engines, provided with a simple and ingenious device, by means of which they may be run either singly or duplex, the change from one condition to the other being made at will.

The machines are very handsome in appearance and finished in a superior manner. The dimensions are as follows: Diameter of initial cylinder, 26 inches; diameter of expansion cylinder, 48 inches; diameter of plungers, 22 inches, and length of stroke 36 inches.

The guaranteed capacity of each pump is $2\frac{1}{2}$ million gallons of water in 24 hours, at a piston speed of 90 feet per minute, or five million gallons for the two pumps in 24 hours This guarantee has been fully sustained, the pumps having at times delivered water at the rate of about $6\frac{1}{4}$ millions in the given time. One marked feature in these pumps is that the plungers work *outside* the water cylinders, so that there can be no possible "slip" in the water ends, as occurs in all pumps when the plungers work *inside* the water cylinders. Therefore these pumps are accurate water meters and send all the water credited to them through the mains.

The trial lasted for twelve consecutive hours, commencing at 8 a. m. and ending at 8 p. m. Total number of strokes, 44,588; average number of strokes per minute, 61.92; average length of stroke, $36\frac{1}{4}$ inches; capacity of pump per stroke, 60,064 gallons; total amount of water pumped, 2,678,133 gallons, or 22,335,634 pounds. Total lift, including friction in force mains—although the pond is somewhat lower, assumed to be the same as at the previous trial—217.52 feet. Total weight of coal burned 6,817 pounds; duty 71,269,579 pounds of water raised one foot high with 100 pounds of coal, an excess of about 11 per cent. over guarantee, which was 65,000,000 pounds.

The Davidson pumps have each their own suction and delivery pipes and check valves, which would materially add to the friction, but for which the company asks no credit. During the trial the fires were cleaned twice in one furnace and once in the other, and when inspected at expiration of trial were pronounced in good order, the slice bar being run through them to show their condition. The Mayor and other members of the City Government were present when the test was concluded, and expressed themselves highly gratified at the result.

The tests were made under the direction and superintendence of Wm J. Martine, chief engineer of the Buffalo Water Works.

Edward B. Meatyard and James White, of Geneva, Wis., have patented an improvement in the manufacture of car wheels. The invention consists in casting a hub of soft steel to a web of forged elastic sheet metal, with special means of welding the parts firmly together. As the ordinary cast-iron wheel is becoming a dangerous factor in railroad operating, it will soon have to be replaced by something less liable to break. The parties who can get out a wheel that can be made comparatively cheap, and strong enough to withstand the blows inseparable from increasing train speed, will strike a bonanza.

John Hyatt of Newark, N. J., inventor of celluloid, has just taken out three new patents. One is a machine for perforating sheet metal, the work being done by rollers with projections which alternate into grooves on other rollers. The second patent is for a filtering agent, which will probably be used in connection with the apparatus operated by the Newark Filtering Company, which was invented by Mr. Hyatt. The third patent is for a differential pressure gauge, which consists of a fork-shaped glass tube the ends being enclosed in separate chambers. The proper inlet and outlet apertures are provided and the indications are made by the use of mercury and a fluid which rise or fall as the pressure is applied.

Drill Presses' Faults and Virtues.

By OBERLIN SMITH.

Having in former articles discussed, more or less thoroughly, the faults of lathes and planers, I will herein glance at some of the salient points which need reforming in the tool named in the title above.

The best modern upright *drills* (or drill-presses, to use the more definite name) are perhaps the nearest perfect of any of our machine tools. They would, in common with other tools, be better if they contained twice as much metal; but the need of what I have, in a former article, termed the "anvil principle," is not in these machines so great as it is in almost all other kinds. The tendency towards vibration and chattering is, in a properly-made twist drill, or other boring tool, almost *nil*. In any such tool having two or more cutting edges, the stress, which would tend to push an edge away from its work, is resisted by solid metal and balanced by a similar stress upon the opposite edge or edges of the tool. In this class of machines, therefore, the designer is not troubled with a fear of his cutter springing away from the finished surface which is being produced, as is the case in almost all other machine tools. In this case the yielding of the cutter, on account of the members of the machine springing out of shape, is in

a direction parallel to the surface being cut, or at least nearly so. In the old-fashioned "arch" form of drill-presses, where the vertical strains were taken by opposite uprights on each side of the spindle, this yielding from the work was practically in a parallel direction with the axis of the hole being bored, and therefore the accuracy of the work was maintained.

In the much more convenient and desirable modern forms of the machine, where the working parts project sidewise from a main vertical post, the tendency of the parts springing under the feeding pressure is to throw the spindle out of alignment with a perpendicular to the table.

It is, therefore, very important that the frame and table should be built particularly stiff rather than "anvilic."

In regard to spindles, the comparatively enormous diameters desirable for lathes are here not necessary, as the cutting is always done at the end of a radius which will average very much shorter than in a lathe of the same general capacity. An increased diameter of 25 to 50 per cent. would, however, be a move in the right direction. For ordinary drilling the torsional strength is abundant as now made, but when the spindle happens to be fed out a long distance below its lower bearing it is liable to lateral deflection. This is particularly objectionable in cases where it is desirable to accurately fix the position of a hole without the use of a jig or templet to guide the drill. To meet these same cases the lower spindle bearing should be made adjustable for wear—a point that is usually neglected in American-built drill presses. For heavy boring work this enlargement of spindles is an important matter, not only to give lateral stiffness, but for torsional strength also.

The matter of the hole in the lower end of a spindle to receive the boring tool is, of course, one of individual preference (often prompted by some species of total depravity), but probably the nearest the manufacturer could come to guessing at an average career of usefulness would be to bore and ream to some size of "Morse taper"—preferably the largest size that was suited to the capacity of the machine. This "Morse taper," as was intimated in a former article, is a barbarously gotten up and nearly systemless system, but is at present the best thing we have that is at all in general use.

As regards the general design of the best modern drill presses, it is pretty much one thing—the main column rising from a flat bed-plate and supporting an elevating table and spindle and feeding arrangements upon one side (the front), while a horizontal driving shaft and countershaft, with their necessary cone pulleys, fast-and-loose pulleys, &c., are supported at the other. The larger sizes are very properly supplied with "back-gearing" and automatic feeding apparatus. In the best makes of these machines the pulleys, gearing, and feeding devices are all so excellently arranged as to scarcely need criticism—that is, until the halcyon days soon, we hope, to come, when all our machine tools shall have some arrangement superseding the barbaric cone pulleys and loose pulleys, by which a stoppage, a maximum speed, or *any* intermediate speed, in *either* direction, may be instantly obtained at a touch from the operator. (Query: Must we wait for this until the day of "individual-machine" electro-motors?)

In speaking of feeding devices, it should be said that the most convenient are undoubtedly those in which the spindle can be very quickly lowered or raised, through a considerable distance, by means of a lever; and with the other hand slowly and powerfully fed down with a round-rimmed wheel, provided with a crank handle. The best automatic feeds are auxiliary merely to the above devices, and cone *gearing* should be used rather than cone pulleys and belt for changing their speed.

Other features desirable in a machine of the greatest general utility (not for special work only) are the adjustable balanced head, balanced spindle, revolving table and swinging table arm. Of the devices for raising and lowering this latter, those arranged with a worm-gear, rather than a ratchet, are preferable, as they cannot "run away."

Among things that ought to be but are not, even on the best drill presses, may be mentioned a "dead center," capable of being quickly set in either the bed-plate or table, exactly in the axial line of the spindle—also a sleeve, set in the bed-plate, adjustable in height and fitted with several sizes of bushings in which to run the lower ends of various boring bars. Another important improvement, especially in large sized machines, would be to make the bed plate extend much further forward than is customary and also to make it wider sidewise. This allows large work to be slid about in various positions in a given plane, without having to stop and level it up each time it is moved, with a resultant smashing of the third commandment and the interest to pay on a liberal investment in crooked wooden blocks, old nuts, handleless hammers, cold chisels, strips of tin and other tip-overy forms of blocking that are usually piled upon springy floor boards to give an appearance of trying to hold something up.

The last 36" drill-press purchased by the writer was altered to conform to the above idea. The old bed-plate was taken off and sent to the pattern shop to be used as a "flat plate" on which to lay out woodwork. A new plate was substituted, about 6 feet long, 2½ feet wide and 4 inches thick, filled with tee-slats and provided with a sleeve for boring bars, as above described. It is needless to say that it has proved a most excellent investment.

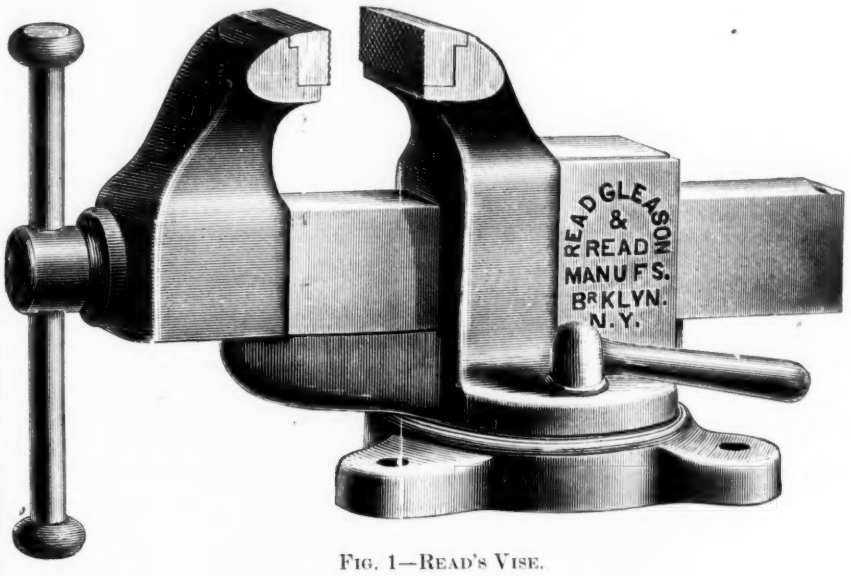


FIG. 1—READ'S VISE.

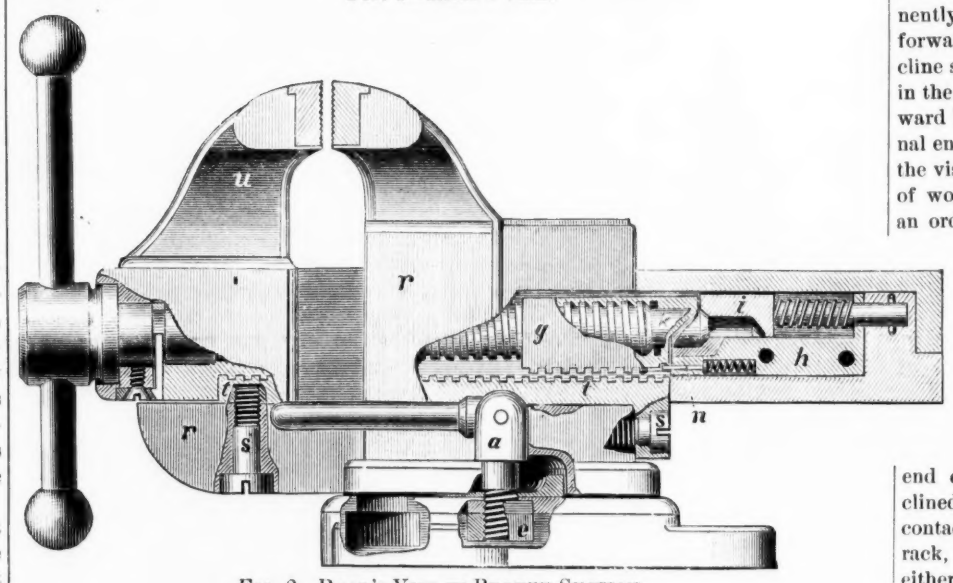


FIG. 2—READ'S VISE IN BROKEN SECTION.

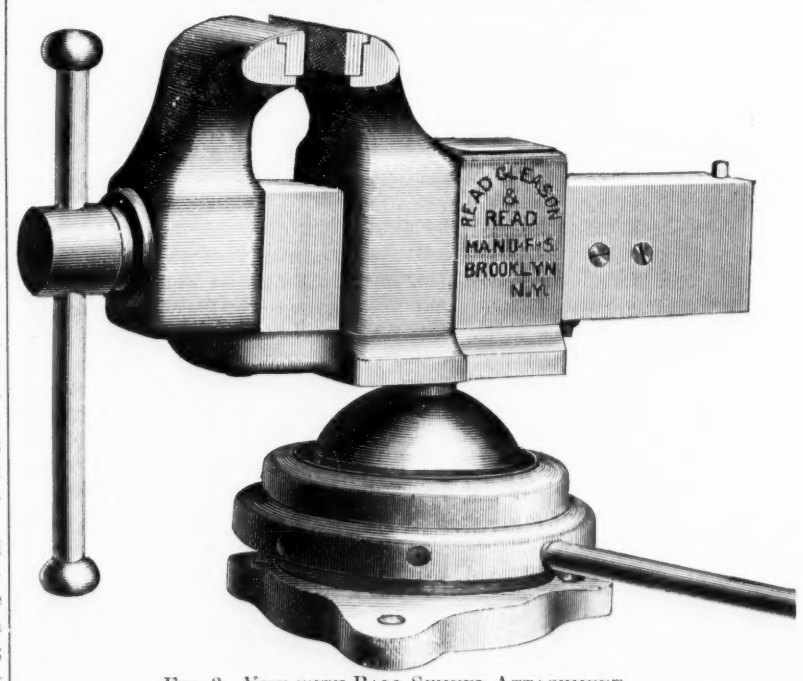


FIG. 3—VISE WITH BALL SWIVEL ATTACHMENT.

Another valuable modification in present practice is to have the motion of a drilling spindle reversible, that the machine may be used for *tapping* holes immediately after drilling them, before the work is unset. This is also useful for *facing* the under side of bored work with the same cutters that are used "right-handed" for upper-side facing.

The matter of design of frame remains to be considered. I have prepared several illustrations showing variations in style among a number of good machines which are adapted for exactly the same work. These I propose to treat in a separate paper.

Read's Improved Vise.

In the accompanying engravings, Fig. 1 represents in perspective, and Fig. 2 in broken section, a new vise made for general use in all sizes, by Read, Gleason & Read, 136-144 First St., Brooklyn, E. D., N. Y. The peculiarities of the construction of this vise may be seen from an inspection of the engravings. The top of the vise may be swivelled to any position on the base, being guided by two nuts in a T-shaped slot in the base, and locked in any desired position by means of two pivoted levers, one of which is shown at *a*.

The loose jaw is moved in either direction a comparatively short distance by means of a screw working in a solid steel nut, the square teeth on the bottom surface of this nut engaging with corresponding teeth on the rack *t*. The arrangement is such that by the operation of the lever, the same as in clamping or unclamping pieces, the teeth on the nut and rack may be engaged or disengaged. When engaged, the vise is in condition to clamp pieces to be held, and when disengaged the jaw may be instantly slid to any position within the range of the vise. The engagement and disengagement is accomplished as follows: The back end of the nut is inclined upwards, and a box *h*, permanently fastened in the sliding bar, has on its forward end a corresponding downward incline surface. In the box is a concave piece in the form of a half box that is pressed forward by the spring shown, and fits the journal end *K* of the screw. Suppose, now, that the vise is in adjustment for certain pieces of work, the vise is operated precisely as an ordinary vise, the teeth on the nut and rack engaging and moving the jaw, with the whole length of the nut always in use. If now it is desired to move the jaw in either direction further than is provided for by the direct action of the screw, the lever is turned in a direction to unscrew the vise. This moves the nut back and forces the half box *i* off the end of the screw, and brings the inclined surfaces of the box *h* and nut *g* into contact, thereby raising the nut from the rack, which leaves the jaw free to move in either direction. A plate *n*, in the lower front end of box, is carried under the box when it is lifted from the rack, and securely holds it from falling back against the rack. The jaw having been moved to the desired position, a reverse motion of the lever reverses the operations just described, throwing the nut and rack into gear and locking them together, the half box *i* preventing the nut from lifting.

Fig. 3 represents this vise with the universal swivel attachment. This arrangement shows the vise as more particularly designed for use in small sizes. In this a spherical projection on the bottom of the vise proper fits a corresponding spherical seat in the base. The screw cup has holes for a lever, as represented, the whole permitting the vise to be swivelled at any reasonable angle in either direction.

Successful High Belt Speed.

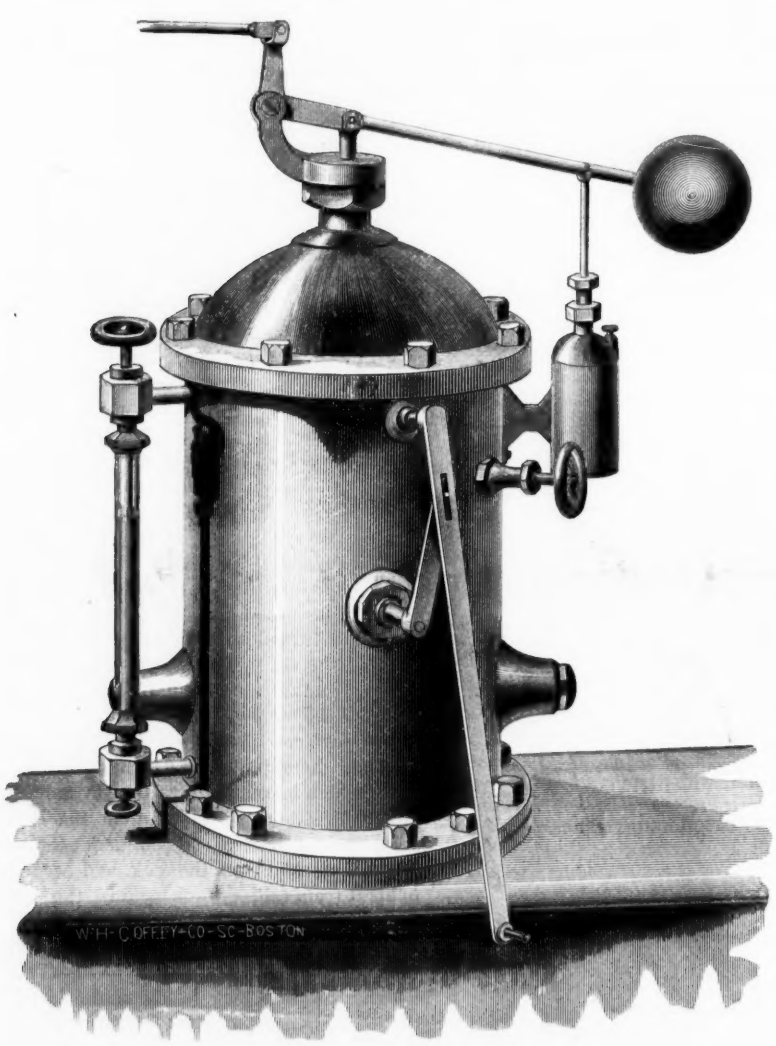
The subject of high belt speed is one frequently discussed, not a few taking the ground that there is a limit moderately low beyond which the tendency of the belt to leave the pulley neutralizes any advantages. An interesting example of belt speed beyond that usually thought advisable, may be seen at the steel works of Spaulding, Jennings & Co., at West Bergen, N. J. In the re-arrangement of their mill they drive a nine-inch train, three rolls high, with a 150-horse power Westinghouse engine, and at a belt speed of more than 7,500 feet per minute, the engine running at 300 revolutions. Although, as will be seen, this speed is about ninety miles per hour, the driving appears to be entirely satisfactory.

The Mason Regulator.

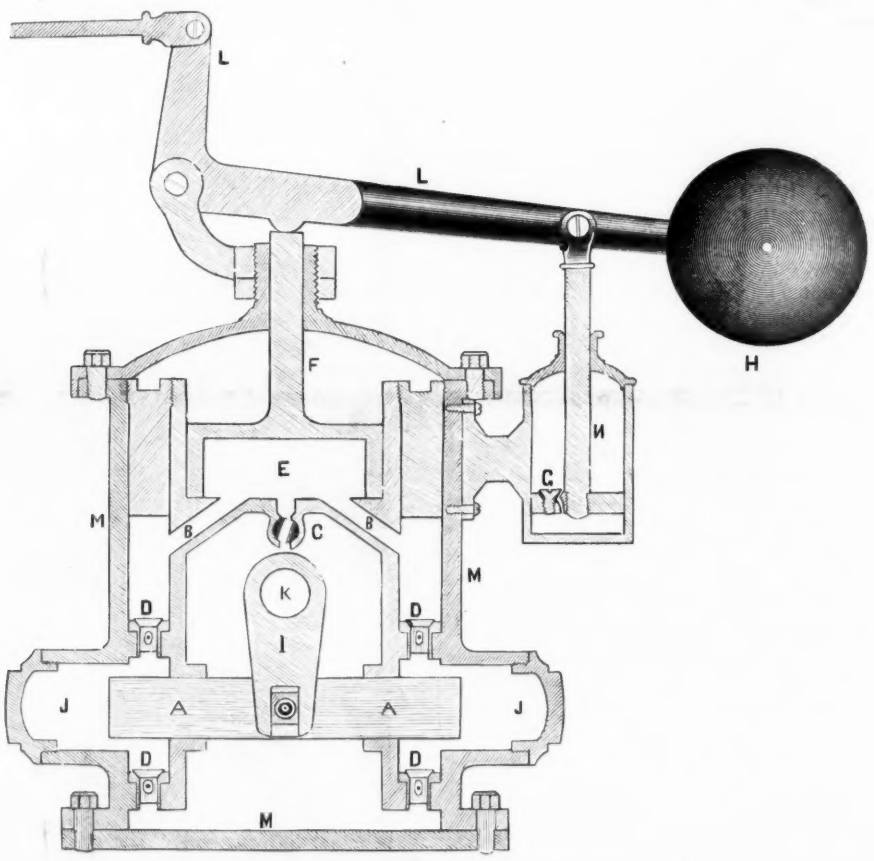
The two engravings represent in perspective and section a device for regulating the speed of all kinds of motors in common use, and especially for regulating direct-acting steam pumps, either simple or duplex.

It consists essentially of a cylindrical shell, filled with oil or other liquid. A plunger *A* is connected by means of the arm *I* to some reciprocating part of the engine or pump, and moves, in unison with the stroke, each way into the chambers, *J, J*. This forces the liquid into the chamber *E*, the liquid returning through the passage *C*, to be pumped over again. If the speed is increased beyond that intended, more liquid is pumped than can return through *E*, and the piston *F* is raised, which by means of the lever *L*, partially closes the throttle valve, reducing the speed.

By opening or closing, in a degree, the passage *C*, the speed can be changed at will. Should any oil work up around the piston *F*, it returns through a passage (not shown in the engraving) into the reservoir *C*.



THE MASON SPEED REGULATOR.



SECTION OF MASON SPEED REGULATOR.

No packing is required anywhere except around the shaft *K*, where it passes out of the shell. The oil is kept sufficiently high in the reservoir to lubricate the journals of this shaft.

The small cylinder seen at the side of the reservoir, and near the top, is filled with liquid and fitted with a piston that connects with a weighted lever. This piston is provided with small openings that permit the oil to pass from one side to the other as it raises and falls. The object of this is to prevent too sudden action of the regulator.

As will be seen, this regulator is simple, easily attached, and the working parts are immersed in oil, which should make it durable. It is made by the Mason Regulator Company, 22 Central street, Boston, Mass.

The Rogers Locomotive Works have six double-headed drilling machines at work, made by William B. Bement & Son, Philadelphia. All heavy work to be drilled is taken to these machines, and in most instances is moved by a differential windlass. By this means all changes of the work are accomplished with little hand labor.

Original Discovery of Iron and Steel.

In an address on technical training, delivered before the Alumni Association of Lehigh University, Thomas M. Drown pictures the discovery of metallic iron and steel in this way: "Nearly all the early discoveries in the arts were the result of accident or hap-hazard experiment. We can well imagine that a fire large and intense enough to reduce iron from its ore, must often have been made in accidental contact with surface ore, and that the presence of the metal in the ashes must have attracted attention. This observation once made, there would follow a series of experiments to determine the conditions under which the metal was produced, and the substances necessary for its production. It would not long escape intelligent observation, that a certain brown earth, or may be a black rock, was the substance which yielded the metal, and that fire was the necessary condition of its formation.

"But the iron thus accidentally produced—a mixture of metal, cinder, and ashes—was of no value till further experiment revealed the fact that the metal could when hot be united by hammering into one mass, with the separation of cinder and other extraneous matter. The discovery of this property prompted still further experiment. The irregularity of the product would suggest the more perfect control of the fire, and small furnaces would be built. In the course of time it would be noted that the iron was not uniform in hardness, and an accident would be sure to reveal the fact that sometimes the metal, when suddenly cooled in water, would become intensely hard. This new line of investigation would result in the production of steel."

The British Press on Improvements of American Locomotives.

Certain British mechanical journals are deriving much satisfaction for themselves and their friends from the statements contained in the paper by Mr. Dean, on "Improvement of Locomotives," read before the last American Master Mechanics' convention. The mechanical journals alluded to have been telling the world, these many years, that nowhere out of the British isles is the art of locomotive building properly understood, and that the benighted Yankees were particularly far behind in this kind of mechanical work. Assertions of that character did not carry much weight, since the writers could scarcely be regarded as disinterested parties. But now they claim to have received the very highest corroboratory evidence that everything they have alleged against the American locomotive is true; besides attention is now drawn to many other objectionable features which they had before omitted to mention.

They now tell their readers that a member of the American Master Mechanics' Association, an organization composed of the leading locomotive superintendents and locomotive builders in this country, submitted a paper at the annual meeting of the Association in which, he proceeded to prove, that the American locomotive is the worst built and most extravagant engine in the world. Figures were produced to substantiate this claim, and their accuracy remained unshaken.

They are sorry that we did not see the error of our ways before we had gone into building so many locomotives without consulting British methods; but they feel assured that Mr. Dean is inspired to lead the nation out of the wilderness A compassionate article in this strain points the desired way of repentance, which lies in imitating our English cousins. They say, "Mr. Dean concluded by stating that there were simple ways out of the dilemma in which locomotive-building engineers find themselves placed in America, when asked to draw heavy trains at fast speeds. The present type of locomotive had not, he was sure, outlived its usefulness, but many of the improvements effected on British-built engines could be introduced on American locomotives, which were capable of considerable extensions in various ways, all moreover contributing to its cheapness, power, economy, and durability."

Operating the Elevated Railroads.

No other city in the world is so effectually, safely, and comfortably supplied with the means of rapid transit as the city of New York. The service of trains throughout the Manhattan Elevated railways is remarkable for accuracy and exemption from serious accident or troublesome delays. No other system of fast city travel, with frequency of trains, can show an equal record for safety and regularity.

The Manhattan Railway Company's lines comprise 32 miles of double track and 80 miles of single track. Upon this structure 240 locomotives are employed to run what averages 3,500 trains each day. A mileage equal to circumnavigating the globe is made every day of the week. About 25 stops are made in each trip, and there has been no single brake failure recorded in six months. The duration of stops at stations averages about 15 seconds. Trains run at intervals varying from a minute and a half to eight minutes, according to the hour of the day and the division of the road. Over 86,000,000 passengers were carried last year; and as the business steadily increases, it is expected that the number will aggregate 100,000,000 this year.

To perform this enormous business with the surprising immunity from accident which has marked the history of the company, an excellent system of operating is essential. This is supplemented by the employment of first-class men, by using the best of machinery and material, and by following a method of thorough inspection.

The whole of the trains are run by card time, and each engineer is held responsible for the safety of his train, the approach to stations and curves demanding constant care and caution. Signal discs or lanterns, carried in front of the engine, denote to switchmen the destination of the train. At the end of each trip the engine is thoroughly inspected by the engineer, and at headquarters a competent machinist is employed for inspecting every part of the engine with the most searching minuteness. All the running gear of the cars is constantly subjected to a similar system of recurring examination. By this means accidents are almost unknown, for the small defects which pave the way for breakage are detected in time and the remedy applied.

The greater part of the locomotives have double crews, each set of men being required to work about eight hours. Each engineer is responsible for the care of his engine during the time he is in charge, and the work of packing, etc., is divided between the two crews. At the end of each trip the engineer makes a written report of the condition of the engine; and if any repairs are needed, they are at once attended to. As the engineers do not like to miss anything which is likely to be found by the inspector, they pay strict attention to the examination of their engines. The object of the greatest solicitude seems to be the brake gear. The Eames vacuum brake, which is used on all the rolling stock of this company, appears to be thoroughly reliable and prompt in action. The part most liable to fail is the

rubber vacuum cylinder, which is never allowed to get worn out before being changed.

The engineers employed on the Manhattan Railway are all promoted from firemen. They are divided into three classes, and are paid accordingly. The first class receives $3.50; second class, $3 25, and the third class, $3 per day. Firemen are divided into two classes, and are paid $2 and $1.75 respectively. An essential requisite for a fireman being eligible for promotion is steadiness and good conduct. Before being intrusted with the care of an engine, he is required to pass an examination, where his knowledge respecting the locomotive is ascertained. He is questioned regarding combustion, the action of steam in the cylinders, and the construction and operating of the vacuum brake. As a practical test of his knowledge, he is requested to state what he would do in case of certain accidents happening to the engines. The firemen generally pass through this ordeal satisfactorily, and it is considered a benefit to the men in making them think. The fact that such an examination has to be passed on the way to promotion, is an incentive to the attainment of accurate knowledge.

On the ordinary run of elevated railway service a locomotive runs about twenty months, making a mileage of 100 miles each day, before needing to go into the shops for a thorough repair. The engines are taken one day each month for washing out and small repairs. Fires are never drawn, except when the engine goes in to be washed or repaired

Hydraulic Press for Electric Light Carbons.

We present on this page the engraving of a hydraulic press specially manufactured by John Robertson & Co. of Brooklyn, N. Y., for the purpose of making carbons for electric lights.

The steadiness and durability of an electric light depend to a great extent upon the character of the carbons used, and a machine which will greatly increase the solidity and homogeneity of the carbons directly tends to improve the light.

It seems to be acknowledged that this press has been a decided success in improving the carbons, and there is quite a demand for it among parties using large numbers of electric lights.

The main cylinder of the press is copper-lined with double-acting water ram. This ram is kept in line by a heavy gland, which in turn is guided by the heavy brace rods that hold the water and carbon cylinders together. Around the carbon cylinder there is a steam jacket for the purpose of heating the mixture to the proper temperature before it is pressed. When this point is reached the tension is applied and the carbons are forced through a die at the end of the cylinder. The fit of the ram is so close that it is necessary to force it back as well as forward, and this is accomplished by applying a reversed pressure which greatly accelerates the work.

The material used for making the carbons is the purest carbonaceous substance that can be found, and the finest coke or the lining of gas retorts is generally selected. These materials are ground to an impalpable powder and mixed with an adhesive substance before being put in the cylinder.

After coming through the dies the carbons are dried in an oven, then roasted in a crucible. When they emerge from this hot ordeal they are intensely hard and compact, the fracture resembling steel, and they ring like a metallic rod. Dies for this press are made to produce carbons varying from ⅛″ to ½″ diameter. The workmanship on the press is admirable.

A machine firm in Philadelphia recently was asked to construct a small machine which had just been invented. They did the work in good shape and found the cost was nearly $200. They then undertook to manufacture the machine for $10 each when an order for 1,000 was given. This is an example of the reduction of first cost by systematic manufacturing processes.

Caustic Soda Condenser for Locomotives.

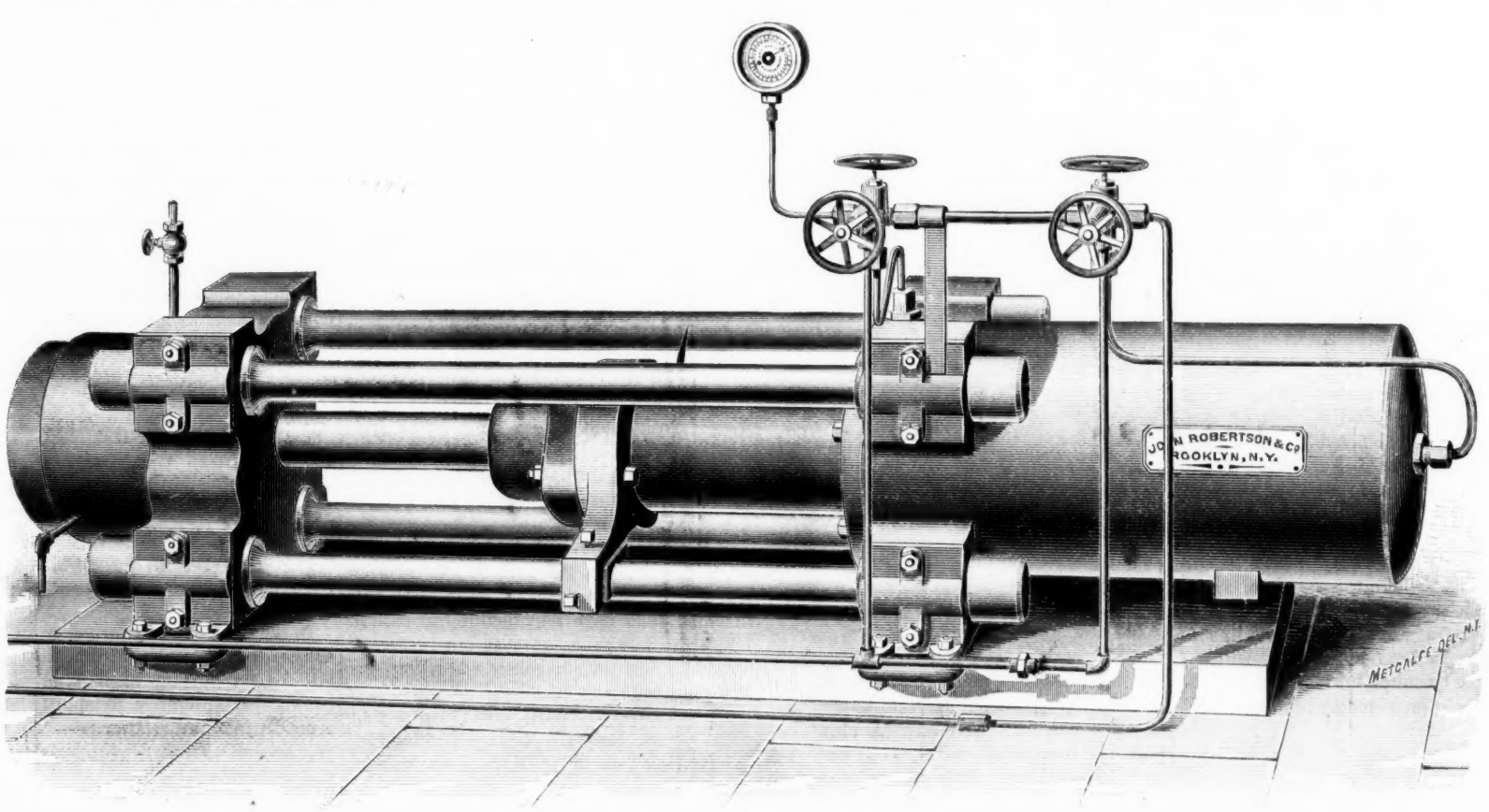
A German inventor has produced an ingenious traction engine where a reservoir of caustic soda is made to act as a steam condenser, and also to perform the purpose of returning the heat of the exhaust steam to the boiler. It is well known that caustic soda is a highly hygroscopic substance, with a strong affinity for water in whatever shape it can be reached. Advantage is taken of this property to make a body of caustic soda absorb the exhaust steam of the engine. The chemical reaction of water combining with caustic soda releases a great quantity of heat which in this case is utilized in maintaining the temperature of the boiler.

The boiler of this condensing engine is made of two cylinders, one inside of the other, leaving a cavity between the shells. This is the reservoir where the caustic soda is stored. When the hot steam is condensed here its temperature is added to the heat resulting from chemical combination, and the greater part of this is absorbed by the water inside the boiler. It is a fireless locomotive. The water inside the boiler is heated by an outside connection to the temperature needed for working, and the caustic soda arrangement absorbs the heat, so that work can be done for a considerable time without replenishing the temperature.

In fact, the chemical reaction continually going on supplies a source of heat, and the exhaustion of the power only takes place when the caustic soda gets so diluted that it will not condense the steam.

With 1,100 lbs. of caustic soda of 1.7 specific gravity the inventor of the engine was able to run for five hours developing about 4-horse power. When the soda becomes degenerated by use it does not become worthless, for its chemical power can be restored by evaporating the moisture which it has absorbed. By this means it can be used a great many times. The claim is made that this is a very economical system of fireless locomotion.

Alexander B. W. Kennedy, Professor of Engineering and Mechanical Technology at University College, London, has been nominated by the Government to serve as engineer in a section of the Amsterdam exhibition.



HYDRAULIC PRESS FOR ELECTRIC LIGHT CARBONS.

LETTERS FROM PRACTICAL MEN.

The Standard Gear Tooth.

Editor American Machinist:

A great advantage would be gained by the general adoption by machinists of some fixed and uniform system with regard to the teeth of gears, for, although there is now a fairly general agreement as to some particulars, it is not enough to accomplish the objects of uniformity and interchangeability.

The tooth of a gear can vary as to three particulars: the pitch, the proportion between pitch and depth, and the shape of the working curve.

The nearly general adoption of the diametral system of pitches leaves little to be desired in that particular, the system having displaced the old circular pitch system except for the largest and coarsest description of work. The mechanic of this day, who speaks of ¼″ or ⅜″ pitch, is probably an old fogy who learned the trade long years ago, while twelve or eight pitch, in their stead, are terms readily understood and generally used.

There is nothing but the persistence of old customs to prevent the general adoption of the diametral system for teeth of all sorts, large or small.

In the proportion between the pitch of the tooth and its depth, the great simplicity of the diametral system leaves no chance for improvement.

Where the circular pitch is in use, each manufacturer can have his own pet proportion, one concern preferring a short tooth and the next a long one, and there can be no uniformity, because no one style has an advantage over others.

But with the diametral system the rule that the working depth of the tooth shall be two pitch parts of an inch is so simple and correct that there can be no disagreement. Nothing stands in the way of uniformity with regard to this proportion except the at present limited use of the old-fashioned circular pitch.

With regard to the shape of the working curve, there is considerable controversy and difference of opinion, sometimes with real reason, but generally the result of long-continued habit, or of the personal pride some concerns take in having a way of their own for everything they do.

There are and can be but two correct forms for the shape of the working surface of the tooth. Both forms are theoretically correct, but in practice, and that is the main thing to be kept in view, there are differences which the mechanician must consider.

Theoretically, the epicycloidal, or double curve, has the most direct action, tends to create the least thrust upon the shaft bearings, and therefore the least friction, but practically the difference is so small, and so much influenced by the deviation of the actual shape from the true shape, as not to be noticeable In extreme cases, such as of a rack-and-pinion, the difference in amount of thrust might possibly be measurable; but, in general, it is easier to prove it mathematically than to find and measure it.

On the other hand, the involute, or single curve form, has advantages which can be seen and practically used, as well as theoretically demonstrated, which, for every-day use, makes it by all odds the best. The single curve will admit of the slight but inevitable inaccuracies in shape and in the mounting of the gears, and will allow of the slight variations from true and square work, which every one knows is universal, and not to be avoided.

A slight variation in making or from wear, from the true distance between shafts, or in the alignment of the shafts, or in the radial direction of the tooth, will make great trouble with the double curve and but little with the single curve.

If machinists could work as close to per-

fect accuracy as writers on gearing can make their rules, the double curve would be the best; but as the case stands, the single curve meets the requirements of practice much more nearly than its rival, is much more worthy of general adoption as a standard, and, in fact, is at this day in more general use and favor.

And, again, to the practical man, not the professor, who works out the formulæ and deals in fine lines and long numbers, but the mechanic who makes the gear itself and his living at the same time, the chief point is to get the most work done in the best manner for the least money, and to do this it is essential to use a cutter that can be kept sharp.

The rose cutter, having many teeth, each one relieved or cut back through its whole outline, can be kept sharp only for a short time while it is new, and then, as its edge is dulled, it works harder, heats more, and does rougher and slower work until it is thrown away or annealed and shaped over. The improved form of cutter, known as the Brown & Sharpe cutter, from the firm that invented and introduced it, has fewer teeth, but of such a peculiar form that they can be repeatedly ground and kept sharp, being as good as new until entirely ground away. Where this difference between cutters bears upon the shape of the tooth, is in the fact that the double curve is not as well adapted as the single curve for the B. & S. cutter, for it has a part of its outline at right angles to the pitch line, where the peculiar method of relief makes a square cutting edge and gives no relief at all. The cutting edge at and near the pitch line does not cut, but scrapes and pushes off the metal.

If the double curve is adopted, the rose cutter, much inferior to the improved form in efficiency and durability, should be used; while, if the single curve is favored, the repairable cutter works to full advantage.

In questions of this kind, the mechanic, and not the learned mathematician, is the judge and the jury; and matters of convenience, cost and efficiency have more weight than matters of pure theory, and therefore the involute is rapidly and justly coming into favor as the proper shape for gear teeth.

The object of uniformity would be still further assisted if there was a general agreement as to the proportion between the pitch and the face of a gear wheel, according to the following table, for example, which I have found to be suited to almost every case, the face being approximately four times the depth of the tooth:

PITCH.								
4	6	8	10	12	16	24	32	48
FACE.								
2	1½	1	¾	⅝	⅜	¼	$\frac{3}{16}$	⅛

There is room for a very general discussion of this subject, and I make the proposition that the best practice lies in the universal use of the diametral system of pitch and proportion, the involute form of tooth and the repairable cutter, for the reasons that they are not only the best, but also that they are now in the most general use.

I hope that those who use and believe in the old circular pitch, the epicycloidal tooth, and the rose cutter, will stand up and give their reasons. GEO. B. GRANT.

Boston, Mass.

Color Test in Tempering.

Editor American Machinist:

Reading the articles by Mr. Goodyear and others on tempering steel, I am reminded of a joke played on the "Professor," as he is called, in "our shop," which will illustrate the value of the color test. The "Professor" has a habit of hardening all work first, and then drawing the temper. One day, among other things required to be tempered were a lot of milling cutters of various sizes. These were duly hardened and tested with a file, and then left with one of the cubs to be polished for tempering. Said cub performed his part of the work, and then placed with the lot another cutter, which had been annealed. All were duly carried back to the smith-shop and the temper carefully drawn. Upon being returned to the tool room the cub was called upon to apply the file test again, with the result of finding one cutter which looked exactly like the rest so far as color was concerned, but which was nearly soft enough to bite with the teeth. It was some time before the "Professor" heard the last of tempering that soft cutter.

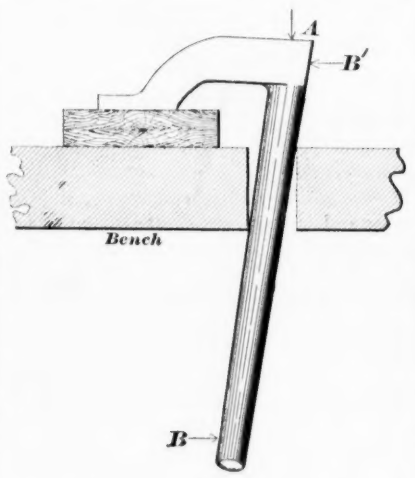
Cincinnati, O. STUDENT.

French Calipers—A Handy Carpenter's Tool.

Editor American Machinist:

Noticing "Chordal's" remarks about the use of calipers, in your issue of August 11th, it seems to me interesting for your readers to know that here, in France, the *mécaniciens*, as they are called, always use a vernier caliper. These cost from 80 cents to $3, the average workman paying about $1.50. It is just as important a part of his kit as his metre measure, and the two in fact usually complete his personal stock of tools. These calipers read to $\frac{1}{10}$ millimetres, say $\frac{4}{100}$ inch. In the best shops they work to this accuracy, but the average machinist hardly knows better than to read to a millimetre "feeble" or "strong." A $1.50 tool will measure up to six or eight inches, and serve both for inside and outside calipers.

The carpenters here have a tool unknown, as far as I can ascertain, in America, which to me seems useful. One cannot say as much for all French tools. They have all their benches made in hardwood, say three to four inches thick. They bore several 1¼ inch holes, at different parts, and with a



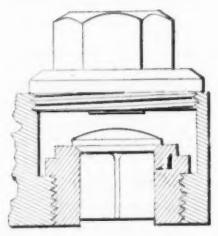
piece of iron shaped like the figure, they clamp a board to the table. A blow at *A* jams the iron in the wood, while one at *B* or *B'* loosens it up. This tool is in constant use for sawing off, splitting, and general working of a board, and is very useful.

P. W., 3 Rue Scribe, Paris.

A Curious Air Pump Disorder.

Editor American Machinist:

The article which Angus Sinclair had in the AMERICAN MACHINIST of May 26, on "Air Pump Disorders" is very full and interesting, and contains much of the information which a man working on air pumps often wants; but I once came across a cause of trouble which he misses or does not mention. It gave me a great deal of bother before I discovered what was wrong, and it is a trouble very rarely met with. The pump worked as if the exhaust pipe was stopped, or as if some other disorder existed in the steam department. I took the nut off the exhaust pipe close to the pump and found that all clear, then I examined all the works about the steam section of the pump and nothing was wrong there. I put everything together and gave the pump steam, but there was no improvement as yet; still a groaning and straining as if it was a locomotive going up a grade struggling with one too many cars. So then I concluded it must be in the air department, although it did not sound that way. Then I took off the bottom head and found the valves all right. At this point of the proceedings I began to feel kind of sold out, so I put on the bottom head again and tried the steam, but it was no go. Taking the joints apart and putting them together again had not improved the working of the air-pump, although I have heard men tell that they have cured a bad working injector by this means alone. So then I took the valve out of the top delivery air passage, and nothing seemed to be wrong there. I cleaned the seat and put back the valve, but still the pump worked no better. By this time I was losing patience and getting discouraged, but I thought of Job and started in once more determined to find out where the disorder was. I took off the top



nut again, shown in the sketch, and in putting in my finger to pull out the valve, I felt the sleeve *A* move round. Close inspection proved that this sleeve had become loose and worked upwards till the seat of the valve was well up towards the bottom of the covering nut, leaving no room for the valve to lift. I turned the sleeve down to its proper place, drilled a small hole through the casting to reach the sleeve, and put in a set screw to hold it in place. When this operation was finished the pump went to work as well as it ever did.

JOHN MAHONEY.

Vicksburg, Miss.

Who Designed the Lincoln Pattern Milling Machine?

Editor American Machinist:

I note articles on the milling machine appearing from John J. Grant and am pleased to know that somebody is taking the trouble to write up this remarkable tool. I would like to have Mr. Pratt say whether he did design the Lincoln pattern. I bought a milling machine of this style in 1865, and it was so old then that the party could not tell when or where it was made, but said it had been in use 20 or 25 years at least.

If Mr. Grant believes that this is the best style of milling machine it would do him good to travel. We have a set of patterns of this machine that have remained in our pattern house about 10 years, because our customers would not buy such machines when they saw our improved tools.

A. H. BRAINARD,
Supt. Brainard Milling Machine Co.,
Hyde Park, Mass.

Screw Machines Without Instruction in their Use—V Ways and Flat Ways.

Editor American Machinist:

It was a good thing publishing the details of how to operate the Niles screw machine for turning and threading bolts. It is a very excellent machine in design and workmanship; and if its merits were more widely known, it would come more into general use.

We got a machine for this purpose last year, purchased from somewhere, without the maker's name, and unaccompanied by any instructions. Some of the attachments were missing, and there was not a man in the shop who knew how to work it. They were fortunate in putting a man on it that was cool and deliberate in his movements, and who learned to work it by experience and practice.

If they had put a rushing tear-away on it, he would probably have made a total wreck of the machine.

There are some very good features about this machine as regards rigidity, power and durability. The fast head-stock is cast solid on the shears, thereby permitting the largest possible cone and gear-wheel on the spindle, giving plenty of power. The spindle is very large. The lathe bed has flat-topped slides, and not wretched, small, inverted V's, liable to wear hollow where most used. Although the saddle and turret head, or capstan rest, have extra large bearing surfaces, nothing could work easier. A child could move it. The distance between the cutting edge of the cut-off tool and the slide is very short, the consequence being that a cutting-off tool can be made to go right through the iron with no danger of digging in, so common in ordinary lathes. Instead of beveling the point of the bolt or stud to assist the turret tool in starting with a tool in the front carriage, there is a V-mouthed socket with cutters inverted to perform that operation. This answers capitally, and is really quicker than the other way. There are many good points about the machine, which makers of ordinary lathes would do well to copy.

The makers of some lathes seem to take special pains to make the spindle gearing as powerless as possible, and give the carriage so small a bearing on the shears that they wear slack directly where most used.

A correspondent in your journal advocated increasing the size of V's to planing machine dimensions, to insure durability. If that were done, the saddle would have to be made so heavy and thick to span the shears from the outside V's that there would be considerably less swing over the carriage. When flat shears are used, the saddle bears on the inner edges, and it can be made much thinner, giving a greater swing. It is a well-known fact that friction depends on weight, not surface, and the plan of making a carriage bear only a few inches at the ends is wrong.

Makers of first-class tools understand that well enough; and as milling machines, shapers, etc., are now made with immense flat-bearing sliding surfaces, I hope to see others adopt flat bearings on their lathes. It is singular that high-class machine tools are now invariably made on the severely plain, *bald* style, with a total absence of mouldings, beading and ogeeing; whereas the light, cheap school delight in curved legs, fancy bulges terminating in sharp corners and tremendous polish. J. K. C.

Time-Keeping Methods and Requirements.

Editor American Machinist:

Among the many subjects of interest that your philosophical correspondent "Chordal" has from time to time touched upon, I think that those pertaining to shop systems of most pecuniary interest to those engaged in conducting works.

In the last issue of your paper, at hand, he has treated the subject of time-keeping in detail for the purpose of making up cost accounts, and promises to shortly set forth some further information of what he would recommend to overcome the various difficulties in arriving at a thorough system. Writing from this side of the water, and with perhaps a closer acquaintance with English workmen than with American, I fully indorse the opinion, that no system to be satisfactory should depend upon either a workman's watching a clock, untying and filling up blank forms with symbols, hours, minutes, &c, or in any way taking part in the office work of cost-keeping.

There are two reasons for this that admit of no argument: (1.) Where workmen are being constantly changed, they must be instructed in the mysteries of your particular system, involving an expense in a foreman's time, and a few mistakes, before the new man can be trusted to carry out the system. (2.) Where piece-work is either wholly or partially carried out, the workman occupies the position of a party to a contract, for the time being, between the firm and himself. Ordinary business routine would demand that his statements of time, class of work, &c., should be verified, and each party to the bargain retain something in the form of a receipt.

I have watched various systems of keeping time in different parts of the States, also in England and on the continent. Perhaps the most general plan is sending a clerk into the works each morning, to interfere with the general routine of the place, asking questions, and waiting for the men to fish out little boards with illegible hieroglyphics, or search for chalk-marks on a casting; or, worse than

all, call the foreman to catechise him as to what the man was doing the day before. The only excuse for this system would be a time clerk that knew the details of all the work in progress throughout the works.

The next plan seems to be a system of small slates or cards, or any convenient plan by which the workman can put down his time to each job during the day, and to hand this in each evening. As already pointed out, this demands that each man should perform several things beyond his province, as a successful workman: (1.) To write legibly. (2.) To understand the symbols, and which lot of machines his work belongs to. (3.) To watch the clock, if convenient, or, if not, to leave his work to look at it. (4.) To enter into a question of addition each day to see if his items complete the required hours, and if not, to "fill up" with something to make it balance.

I remember being struck with admiration of some of the systems advocated by "Chordal," and successfully carried out by Mr. Alex. Gordon, at the Niles Tool Works, Hamilton, Ohio; also by the remarks made to me by Mr. Gordon while here last autumn, when he was kind enough to explain some of these improved shop systems. There has been much written about shop systems, and I am inclined to think an attempt to adopt all the various schemes discussed and approved would do more harm than good in most works. System *should* mean the best plan of turning out the largest amount of finished work with the least number of foremen, draughtsmen, clerks, and time-keepers, and the least possible tax on the manager's or principal's time to supervise it all.

* * * * * *

If there is a fault to be found with "Chordal," it is in not giving weight to difficulties in organizing systems and in pointing out that it is a work of years, and can only be arrived at by constant effort and several failures from time to time. There are many schemes that are easily settled by discussion in a half hour, that would demand valuable time and effort for years. I well remember the mental feast that "Chordal" and I enjoyed one evening in mapping out the model machine shop of the future, and I have no doubt both of us, as well as your readers, will always be benefitted and make a step forward by such day (or evening) dreaming.

* * * * * *

After this digression, I will come now to what prompted my letter to you on the question of time-keeping. (You see I am assuming in writing at such length that you can print my letter like "Chordal's," by filling up with asterisks, in which case you can leave out all irrelevant matter.) Enclosed you will find a page from our time-keeper's book, which will explain itself. It is intended to overcome most of the difficulties suggested by "Chordal," and as it has now been in use for three years and given satisfaction, it is at least entitled to be called practical. It is, of course, necessary that all work be represented by symbols, or order numbers, as it would be useless to advocate any improved methods in a work where this elementary plan is not in use. Standard machines have symbols; special orders, like repairs or small outside jobs, have the number of the order; while new tools have a special number from *their* cost-book, but are always specified as N. T., with the order number following; as, N. T. 150 may be a 2" tap, N. T. 151 a set of mandrels, N. T. 152 a drilling jig, &c.

* * * * * *

The rules detailing the use of the coupon tickets are simple, and depend only upon the time-keeper and the foremen of departments. To start with, a new man commences work; a number is given him; the foreman gives him his work and a ticket, as shown.

The tickets in possession of the men on Friday evening are collected by a lad from the office, and new ones handed out each Saturday morning. Whenever a workman is given a new piece of work, the foreman takes the ticket from him and marks on the back of the ticket the symbol of the *new* work and the time at which the change is made. Lads, who are dispersed over the works to run errands for the workmen by bringing tools, oil, waste, etc., run with this ticket to the time-keeper's office, when a new ticket is made out and returned to the workman as before. Every man in the works is at all times in possession of a ticket, and he is liable to a fine or discharge for neglect of this. In the case of settlement for piece work, and to avoid disputes, the workmen are entitled to receive back on Monday all the tickets that have been given to them the previous week. By this means they have a receipt for their time from which they can check the time-keeper's calculations. Even with the greatest precaution mistakes have been made in paying piece work, and only acknowledged when the workmen have brought their coupons to the time-keeper's notice. The symbols of the machines are sooner learned by this system than by the workman gathering it from symbols on the drawings.

* * * * * *

Of course, these tickets are only a part of an elaborate system of cost-keeping, which I may explain in a future letter, but for the present will answer to show how a system can be conducted with a large number of workmen of all degrees of skill and intelligence. The tickets, or coupons, it will be understood, are only to get a detailed account of each workman's time during each day for cost keeping, but have no reference to making up his time for wages each week. We use the workmen's checks deposited by them on going in and taken from a board going out. This is the almost universal plan here in all classes of manufactures.

* * * * * *

We are using another system of *stores keeping* which is of equal importance with time-keeping, and, strange to say, has not been touched upon by "Chordal." It has much to do with reducing the cost of production so far as it can be done by office system. It consists in everything that enters into the construction of the machine's product, passing through a stores department, from whence it is ordered, collected, checked, weighed, distributed, and eventually returned in finished form. All castings, forgings, miscellaneous parts, screws, small finished parts, are delivered into the works from this "central depot."

* * * * * *

I will reserve an account of this for another letter, in describing a new works in process of erection here. Some drawings will accompany it, showing a novel form of works, in which the detail of arrangement I hope will call for some further remarks by "Chordal" on "Shopittecure."

GEO. RICHARDS.

Atlantic Works, Manchester, Eng.

Wire-Rope Transmission by Inclined Grooved Drums.

Editor American Machinist:

Referring to your statement in September 1 that the Brooklyn bridge plan of rope transmission was first used by a Mr. Eppelsheimer in San Francisco in 1872, I desire to say that this identical system of driving an endless rope by two grooved drums with their respective planes of revolution inclined out of parallel an amount equal to pitch of rope grooves, was first patented and applied by S. B. Whiting, M. E., in 1866-7, to the hoisting machinery of the three Lehigh and Susquehanna planes.

This machinery was all designed and built at the Colliery Iron Works, Pottsville, Pa., of which Mr. Whiting was at the time superintendent and engineer.

John A. Roebling & Sons furnished the 2½" wire ropes for these planes, and were much interested in the novel arrangement of the drums, which was universally pronounced to be a great step in advance of any other method in use in the matter of simplicity and saving of wear and tear of the ropes.

Colonel Roebling frequently consulted Mr. Whiting with a view of using his system of rope transmission at the Brooklyn bridge, and in 1877 Colonel Roebling sent Mr. G. W. McNulty, one of his assistant engineers, to Pottsville to examine the working drawings of the Lehigh and Susquehanna plane machinery, from several of which he took tracings.

The drums at the Lehigh and Susquehanna planes are 20' 8.28" diameter, and have the spur wheels combined with the rope drums, so that the work of the engines is transmitted through the spur wheels directly to the ropes without passing around through the main drum shafts and keys. These spur wheels are 20' 8.28' diameter, 130 teeth, 6" pitch, 18" face and are driven by an intermediate pinion of 37 teeth.

The pinion and wheels have their shroudings turned off to the exact diameter of their pitch circles, so that the shroudings roll together and prevent the strains of the ropes from putting any pressure on the sides of the drum-shaft journals.

The pinion teeth are "staggered" or inclined sufficiently to give the teeth a good bearing. Each pinion shaft is driven by a pair of vertical non-condensing 36x48" engines, with cranks set at right angles.

Weston and the Yale and Towne Manufacturing Company are also using the Whiting system of endless rope transmission to work their traveling cranes.

Mr. Whiting's patent having expired, his device is now, of course, public property, and my only object in writing you is to place the credit where it belongs.

E. F. C. DAVIS.

Pottsville, Pa.

[Our correspondent is mistaken in supposing we attribute to Mr. Eppelsheimer the credit of first moving a loaded wire rope by means of two drums, either with their planes of revolution parallel or inclined. We simply credited him with being the first to put the general system, as applied to passenger traffic, to practical use.]

Shop Time-Keeping.

Editor American Machinist:

"Chordal" and others have said a great deal regarding time-keeping in shops. The system of symbolism is comparatively easy to handle in a strictly manufacturing shop; but respecting jobbing and repair shops, it does not reach everything. The following card represents my way of time-keeping. I dare say it merits the name of slight originality anyway:

	Time.	Cast.	Wrought.	Brass.	Steel.	Babbitt Metal.
Order No. 875.	7	×				
Date, 4-18-'82.	2	124				
By Williams...						

Plane 1. Cross-head per drawing. Eng., 12x20, No. 4.

Date..July 30..1883. Workman's No..10..
Book No..891.. Symbol 8 A6..
Description of Work..Planing.....
Time occupied..6 hours .....
Remarks .....
..... Frames and tables.....
....

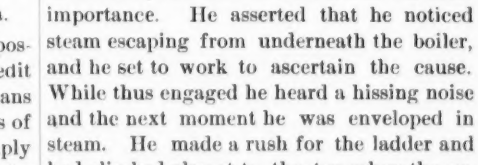
Workman's No..10.. Date..July 30, 1883.
Symbol..8 A6.. Book No..891..
Description of Work..Planing.....
Commenced at..9..
Finished at..4..
Total hours..6 hrs..

Date..July 30..1883. Workman's No..28..
Book No..892.. Symbol..N. T. 150..
Description of Work..2-in. sq. thread tap...
Time occupied..9 hours .....
Remarks .....
.....
.....Turning ready for fluting.....

Workman's No..28.. Date..July 30, 1883.
Symbol..N. T. 150.. Book No..892..
Description of Work..Tap-turning.....
Commenced at..8..
Finished at..6..
Total hours..9 hrs..

The office book shows the number of all orders, as No. 875. The "ticket" shows the date of writing, the name of the man who does the work, the work necessary to be done, the weight of material, &c. I scratch the ticket thus × to indicate that weighing is necessary, and the absence of this mark indicates not to weigh. The time running from one day to the next is checked by the time-keeper every morning in his rounds, and the foreman is saved much trouble. The sum of hours on the "tickets" foots the day. Years afterward it can be easily told what any job cost, the exact items being enumerated. On job work it is simply necessary to state and perhaps sketch the job, as per card:

	Time.	Cast.	Wrought.	Brass.	Steel.	Babbitt Metal.
Order No. 850.						
Date, 4-12-'82.	2					
By Jones.....						



Key-seat 1—3" shaft, per sketch, ¾ wide, $\frac{3}{16}$ deep.

Thus the man is his own time-keeper, expense-keeper, and hates to have a ticket show too many hours on a job. C. A. B.

Kansas City, Mo.

The Riverdale Boiler Explosion.

Another disastrous boiler explosion has happened (August 28) on a Hudson River steamboat. The steamer Riverdale while preparing to make a landing at one of the New York City piers exploded one of her boilers scattering death and destruction around. Five persons were killed and a dozen or more badly injured. The boilers are reported to have been overhauled a year ago, and the Government boiler inspector who examined them last June passed them as safe to carry 40 lbs. steam pressure. The accident occurred when the steam pressure was about 25 lbs. The boat at this writing is at the bottom of the river, and while she remains under water it will be impossible to discover the exact cause of the explosion.

Among a mass of conflicting testimony collected during the excitement succeeding the accident there is little to guide to a correct conclusion as to how the accident originated. The testimony of Geo. A. Deymes, a fireman of the boat, who has since died, is of the most importance. He asserted that he noticed steam escaping from underneath the boiler, and he set to work to ascertain the cause. While thus engaged he heard a hissing noise and the next moment he was enveloped in steam. He made a rush for the ladder and had climbed almost to the top when the explosion occurred, throwing him into the river.

The Railway Age can do the public excellent service and merit the thanks of every honest investor in railway securities by exposing every humbug scheme like that of the "People's Railway Company of America," which is dissected in its issue. It says: "The list of officers attached to the prospectus includes four surgeons. As their services can not possibly be needed for years by wounded employes or passengers on this still unhatched railroad, it must be that they are provided to attend upon sick subscribers to the stock of the company. That the subscribers will be sick is as certain as the sunrise. And the mischief of it is that when the time of awakening and disgust comes, the victims will believe that they have a grievance against railways and will rail and vote against them, forgetting or failing to see that their own foolish credulity is mainly responsible for the inevitable disappointment and loss."

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, SEPTEMBER 15, 1883.

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Industrial Exhibitions this Fall.

Industrial exhibitions are about as numerous as ever this Fall. The Louisville Exhibition, which opened August 1, has hardly yet reached its full tide; but as it continues until about the 1st of November, there is ample time for the development of a more widespread interest. The Cincinnati Exhibition, to run from September 5th to October 6th, promises well. The machinery department will be one of the most prominent, as it always has been in previous exhibitions. We learn that a number of new inventions of merit will be shown.

The exhibition of the New England Manufacturers' and Mechanics' Institute in Boston is to extend from September 5th to some time in October. Displays of products by Southern railroad companies will be one of its most prominent features this Fall. Some of the Southern States have also made special appropriations to make a showing of their products

The Foreign Exhibition, which opened in Boston September 1st, is very peculiar in its scope. Nothing but foreign products are to be shown. It is hard to see why such an exhibition should be undertaken, unless it is to encourage larger importations of foreign goods. Certainly the exhibitors will not consider it a success unless it increases the demand for their wares.

The American Institute Fair in New York City will be held this Fall as usual. The fairs are less valuable from a mechanical standpoint than they formerly were, but new inventions of merit are shown every year, which make it worth while to visit the exhibition. Large numbers of visitors can always be relied upon.

The Pittsburgh Exhibition will extend from September 6th to October 13th. It is more local in its character than those previously mentioned.

The Denver Exhibition, now in progress and to close September 30th, and the San Francisco Exhibition are also in a great measure local.

Much can be learned from a visit to any well-conducted industrial exhibition, and the exhibitors themselves frequently receive large benefit from sales of goods, both mechanical and domestic, to visitors, who thereby learned the merits of the articles. There is, however, a lurking danger of an "over-production" of industrial exhibitions. It costs a machinery manufacturer, for instance, a snug little sum of money to make a display at one exhibition: when he sees the necessity of exhibiting at two or three or five at once, in order to cover the field properly, he often holds aloof from them all for obvious reasons. If there were fewer exhibitions of miscellaneous products, each of them would doubtless pay better, and be more satisfactory to their projectors and to the public who patronize them.

The three great occupations of the people of this country are as follows, in the order of their importance: First, agriculture; second, manufactures; third, commerce. But a person not otherwise informed might be led to suppose, by reading the "leading" daily newspapers, that the chief occupations of the people are: First, struggling for office; second, committing crime; third speculating in stocks, oil and other property.

Petty Impositions.

Americans are a long-suffering people, and they patiently endure annoyances that would cause a revolution in other countries. Especially is this the case with institutions which they consider as serving convenient purpose. Scarcely any real effort is made to overcome the tyranny of steamers and locomotives smothering towns with smoke or burning them with cinders. Fast trains thunder through towns, leaving worse destruction behind them than ever was perpetrated by a Juggernaut car; yet these things are meekly borne by an independent people. Among the worst instruments of torture inflicted upon certain districts is the steam whistle. Otherwise quiet villages and sleeping towns are every few minutes startled by screaming whistles, whose notes are pitched to produce the most ear-piercing howls In most cases the tumult is utterly unnecessary, but the people who suffer from the noise are helpless to prevent it. Few of them are so fortunately connected as was a gentleman in Pittsfield mentioned by a correspondent of the *Troy Standard*. This picturesque New England town was tortured by locomotive whistling. The people were unable to abate the nuisance, but a gentleman who lived near the railroad track invited the superintendent of the railroad to visit him. The whistling disturbed the slumbers of the superintendent, and he promptly put a stop to it for the future. Every town cannot get a superintendent for a guest, but the citizens could agitate to have laws passed dealing with the most prominent railroad nuisances to which they are subjected.

Mistake of a Stopper and Starter.

A few days ago the daily papers reported the death of one man and severe injuries caused to another by the starting of the machinery of a mash-tub, which the men were employed cleaning out. The accident happened in the brewery belonging to Anton Hupfel & Sons, New York. It now turns out that the accident was caused by an incompetent man, employed in place of an engineer, who mistook the starting wheel. This man, whose ignorance or carelessness took away another man's life, was not licensed as an engineer, and the firm employing him were violating the law in having such a man in charge of an engine.

It is gratifying to hear that the managing member of the company has been arrested, charged with a misdemeanor, for employing this man contrary to law. Misdemeanor seems a very mild charge, considering the magnitude of the offense. The killing of one man and the mutilating of another ought certainly to give grounds for an indictment for manslaughter. If the officers of the law would look a little more sharply after the parties who are endangering the public safety by employing incompetent men to perform the duties of engineers, there would be fewer mishaps of this kind.

Saving More than is Wasted.

It is one of the things not easily accounted for that a company organized for a common enough mechanical purpose, and one for which it is essential to secure and maintain the confidence of the public, will start out by making statements that discredit its own knowledge of the subject, or what is equally unfortunate, and less honest, assume that the public are ignorant enough to accept as true palpably incorrect statements. Nothing is easier, generally, than to garble something said or written by another to suit the special purpose, or to put forth as correct statements known to be incorrect, unless it is to manufacture such statements, and nothing more foolish than to suppose they will go unquestioned, or will serve any useful purpose in a mechanical direction. Those who buy new mechanical devices expect two things of those of whom they buy, viz., common honesty and some knowledge of the subject under consideration, and to assume that they will be easily misled in these respects is generally to make a mistake.

A little pamphlet, with the title, "Concerning Combustion," the ostensible object of which is to afford information on the subject indicated, and to advertise a company claiming to control a multitude of patents relating to combustion, serves as well as anything to illustrate this matter. The leading proposition in this pamphlet purports to be an extract from something said or written by a civil engineer, as follows: "Theoretically *one* pound of standard coal contains heat enough to give us one horse-power for one hour. But so crude are our best methods of burning it as yet that under the most favorable conditions, under a stationary boiler, with the aid of an expert stoker, we use *three* pounds." The engineer referred to may have said this in a connection that, had he been quoted entire, would materially modify the meaning; but as it here stands, if it means anything, it means that in the best examples of boilers, and under exceptionable conditions, only one-third of the heat in coal is utilized in making steam. With the record's common reading, in which boilers are shown to have utilized from 70 per cent. to 80 per cent. of the heat in the coal with which they were fired, what occasion is there for believing that those who read this statement that credits them with utilizing only 33 per cent. will accept it as showing anything but ignorance, or an intention to deceive, one of which, so far as success is concerned, is about as bad as the other. Nothing is ever gained, if the purpose is legitimate business in something worth the consideration, in grossly—or to any extent—over-estimating advantages, and it is getting to be that there is no better way to provide against the fair trial of a mechanical device than to attempt its introduction through extravagant representations of its merits. There is room enough for saving in the fuel used, and in a hundred other ways, directly and indirectly connected with industrial pursuits, but the man who is anxious to agree to save a good deal more than is wasted is not likely to get a hearing. The general public are not so ignorant in such matters as they are sometimes supposed to be, and judge with more correctness than they are credited with the difference between facts and assertions without foundation.

One of the English Government representatives who attends the opening of the Northern Pacific Railroad is Geo. Barclay Bruce, an eminent civil engineer. Mr. Bruce was the second pupil of Robert Stephenson, and was for several years a trusted assistant of that celebrated engineer. Among the notable work he did for Robert Stephenson was the testing of the Victoria Bridge over the St. Lawrence.

Literary Notes.

MODERN AMERICAN LOCOMOTIVE ENGINES, their Design, Construction and Management, by Emory Edwards, M. E. Henry Carey Baird & Co., Philadelphia, Pa. Price, $2 by mail.

This book is the last of a series of steam engineering works, compiled by the same writer. No pretension is made to originality in the production of the work. It professes to be articles by standard writers, collected from various sources, the pages of the AMERICAN MACHINIST having furnished a considerable portion of the matter, for which due credit is given. The selections, in most cases, are judiciously made and cover a wide range of subjects in the field of locomotive engineering, and a careful perusal of the book cannot fail to increase the knowledge of the locomotive engineers, to whom it is principally addressed.

In treating of the exclusively scientific portions of steam engineering Mr. Edwards has drawn liberally from the best text-books on the subject, and from the fugitive writings of competent authorities. In the purely practical portions of the book nearly all the names familiar to readers of the AMERICAN MACHINIST, as writers on locomotive subjects, appear under articles. There is scarcely a page in the book where good points cannot be obtained on steam engineering; but, unfortunately, in many cases they do not apply to the locomotive. For instance, the chapter on "Economy of Fuel," by Wm. J. Williams, is an excellent treatise on the subject, but it deals almost exclusively with furnaces of stationary boilers. A similar objection might be raised to the chapter on "The Quality of Steam," by John W. Hill.

Coming to a more practical part, a locomotive engineer who wanted to take motion curves of his valves would find no assistance from the chapter on "Valve Motion Diagrams," simply because it does not apply to locomotive practice. These weaknesses are the natural consequence of the style in which the book is gotten up, and similar objections always apply against articles made to stand muster in a place where they were never intended to appear.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(296) J. H., Peru, Ill., asks: Will lead joints of 4″ cast-iron pipe overground stand a water pressure of 140 pounds per square inch? *A.*—Yes.

(297) G. L., Cincinnati, Ohio, asks: Will you please inform me of a solution that if applied to lead will give it the appearance of highty-polished brass? *A.*—We know of no solution that will be at all satisfactory. Any electrotyper can coat the lead with copper; and if the color does not suit you, you can then have it electroplated with brass.

(298) F. D. B., Olean, N. Y., asks: 1. How can I make blue prints? *A.*—You will find instructions in the AMERICAN MACHINIST of May 28, 1881; October 8, 1881; September 9 and 23, 1882. 2. Is the blue print paper a commercial article, and what is it called? *A.*—It is sold by stationers, and is called "blue process paper."

(299) C. W., Boston, Mass., asks: Would the following dimensions of boiler be suitable to run an engine of about three horse-power in a launch: Diameter of shell, 2 feet; length of tubes, 20″; depth of fire-box, 12″; depth of ash-pan, 4″ *A*—By using the exhaust in the stack you will probably do very well. It would be better, however, if about one-third larger.

(300) P. M., Memphis, Tenn., asks: Will you tell me how to case-harden wrought iron in a bath? I want to harden pieces of iron 4′x½″, about 30″ long, and should like them to be very hard. *A.*—You cannot harden the pieces satisfactorily by the use of a bath. You will find a description of the process of case-hardening in the AMERICAN MACHINIST of December 23, 1882; also in the issue of April 22, 1882.

(301) W. A., Keokuk, Iowa, asks: Is there any more friction on a piston rod having self-adjusting metallic packing the full length of stuffing-box than if the packing is considerably shorter? *A.*—If the packing is held against the rod by a given fixed pressure, the length of it will not materially affect the friction. If the pressure is varied so as to be just sufficient to prevent leakage, the probabilities are that the long packing (unless excessively long), which is not likely to be the case, will cause the least friction, because less pressure will make it tight. If the packing is set by steam pressure, the more surface there is for the steam to act upon the greater the friction.

(302) J. C., Lincoln Park, N. J., asks: Will you tell me of some way by which I can control a small opening in the bottom of a large water tank, so that it will continue to discharge the same quantity of water from the time the tank is full until it is nearly empty? *A.*—You can probably accomplish your purpose by using a float in the tank, connected by means of a lever, or perhaps better by a cord and wheels, to a plug cock. Another way that suggests itself is the use of a tapered rod through the discharge hole, the float raising and lowering the rod, and so decreasing or increasing the area of opening.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

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Universal grinders for lathe-centers, chucks, angles or cylinders. C.C.Hill, 144 La Salle st., Chicago, Ill.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25″ lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Harrison's extra heavy 24″ swing 12-feet bed lathes ready for delivery; also castings and tracings of same. 1708 Barker street, Philadelphia.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Castings furnished for 18″ and 21″ swing engine lathes. Gearing turned and cut if desired. C. F. Batt, Phœnixville, Pa.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, and 1882. A limited number of each sent by express for $4 per volume, express charges to be paid by purchaser. AMER. MACHINIST Publishing Co., 96 Fulton st., New York.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

"Useful Information for Steam Users"—a 100-page illustrated pamphlet, carefully compiled from the best authorities, on the care and management of the steam engine and boiler, with hints for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, New York.

We will pay 25c. each for copies of January 1st and 8th, 1881. They must be clean and in good condition. Any of our readers who are kind enough to send either of the above dates, will please write their name and address on the wrapper. AMERICAN MACHINIST Publishing Company, 96 Fulton street, N. Y.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Credits.—Ealy's "Blue Book," July, 1883, just published, contains a complete classified list of over 100,000 names of machinists and dealers in machinery, railway machinists, engine and boiler makers' supplies, brass goods, metal, etc., in United States and Canada. The book is condensed making it much more convenient to handle than a larger agency book. It gives the financial standing and paying qualities of all dealers and manufacturers in the above-mentioned lines of trade. For terms, etc., address The John W. Ealy Company, 51 Chambers street, New York, or 79 Dearborn st., Chicago, Ill.

MANUFACTURES.

Citizens of Salineville, O., offer a site and $2,000 to any one who will erect a pottery there.

Toy, Bickford & Co., are building a new cotton mill, 50x70 feet in size, at Simsbury, Conn.

The Lawrence Cordage Company, of Brooklyn, E. D., N. Y., are about to put in four new boilers.

The Novelty Iron Works, Cleveland, O., are doing a large business in manufacturing cigar machines.

Harper & Brothers' publishing house, Cliff street, New York, are about to put in two new boilers.

P. & J. Bannigan, 68 Greene street, New York soap works, Lake View, N.J., are putting in a new engine and boiler.

Tuttle & Bailey Manufacturing Company, Brooklyn, E. D., N. Y., have just put in a 30 horse-power boiler.

Hecla Iron Works, North 11th and 2d streets, Brooklyn, N. Y., are about to put in a new 50 horse-power boiler.

The Whitinsville (Mass.) Machine Works are building an extension to their works 360x82 feet, and three stories high.

S. S. White Dental Manufacturing Company, Princes Bay, Staten Island, are about to put in a 60-horse-power boiler.

E. W. Candee, foot of East 53d street, New York, has just built a new cigar factory, and is putting in a new engine and boiler.

The Warren Woolen Company, of Stafford Springs, Conn., has begun to build a three-story brick mill for making fine worsted yarn. The building will be 60x105 feet.

The Holly Manufacturing Company, Lockport N. Y., have completed a 10,000,000-gallon pumping engine for Columbus, O., being the largest ever turned out from their shops.

Horace Lamb will rebuild his wire mills at Northampton, Mass., recently destroyed by fire. The new works will probably be of the same size as the old mills, and they will be built of brick.

Williams, White & Co., Moline, Ill., have recently completed a drop hammer for the Indianapolis Bolt Works, the hammer and die of which weigh 2,300 pounds, and the whole machine twelve tons.

The Solvay Process Company, Syracuse, N. Y., have lately purchased a No 14 Korting injector, locomotive style, to feed a battery of Babcock & Wilcox boilers, amounting to one thousand horse-power.

The new cotton mill at Henderson, Ky., has been organized with a capital of $300,000, of which $100,000 is Eastern capital. Its mill will be 324x95 feet, three stories high, and will operate 21,000 spindles.

The Hugh McKay Manufacturing Company, of London, Canada, have purchased the machine and boiler shops, foundry and stock of the late firm of Foster & McKay, and the new firm will continue in the same business.

The Crescent Manufacturing Company, Cleveland, O., manufacturers Cyclone boiler flue cleaners, Crescent steel flue cleaners, and Crescent boiler compound, have issued a descriptive price list of those articles.

The Norwalk Lock Company, South Norwalk, Conn., have closed a contract for the building of a large addition to their present works, which will comprise a foundry and machine shop for the special working in brass.

The Buckeye Engine Company, Salem, O., have issued a fully-descriptive illustrated circular of the Buckeye automatic cut-off engine. Considerable general information of value to engineers is included in the pamphlet.

It is stated that R. H. Wolff & Co.'s wire mills and steel spring works, which, with the machinery, were burned at Amesville, near Peekskill, N. Y., a few days ago, will be rebuilt in Brooklyn, N. Y. The Amesville works employed 350 men.

The Granite Cotton Mills, at Haw River, N. C., are adding steam power to supplement their water power. They will use a Westinghouse automatic engine of 200 horse power, which will be coupled direct to their jack-shaft, and make 265 revolutions per minute.

Wm. Sellers & Co., of Philadelphia, are working a full force of men on their manufacture of tools. Although the demand is quiet, it seems to be slightly improving. The demand for their injector keeps steadily on the increase, especially for railroad service.

The Union Brass Manufacturing Company, of Chicago, recently gave their employes a picnic for one day. This is commendable, and we would be glad to hear of many other establishments furnishing a day's entertainment to their workmen in the summer season.

Brehmer Brothers, of Philadelphia, report work as being dull in their special line of drill chucks and small tools. They are preparing to go extensively into the manufacture of their automatic bevel gear-cutting machine, a specimen of which has been completed.

Mr. Spencer, of the Billings & Spencer Company, has invented a new magazine shot-gun, and a company has been organized to manufacture it at Windsor, Conn., where a factory is to be erected. The Pratt & Whitney Company have received an order to build the machinery.

Parties in Cheshire, Conn., are talking of establishing a watch manufactory there. A New Haven party has secured a patent on a cheap watch, something on the Waterbury style, and is willing to locate the company there, provided the town raises $25,000 out of a $100,000 capital.

The Yale & Towne Manufacturing Company, Stamford, Conn., have issued a very neatly gotten-up preliminary illustrated and descriptive circular of the various types of cranes made by them. The engravings are first-class, and show intelligibly the machinery they are made to illustrate.

The Baltimore and Ohio Railroad Company are about to erect new brick shops at Glenwood, Pa., to employ several hundred men. The machine shop will be 100x120 feet, the boiler and blacksmith shop 60x120 feet, and the car repair shop 90x120 feet. Twelve acres have been reserved for the site.

The Farrel Foundry and Machine Company, Ansonia, Conn., have added a 60 horse-power Westinghouse automatic engine to drive all their foundry work independent of their main engine and water-wheel. They are also using a smaller one as an independent power for their blower in the forge.

Geo. W. Enderbrock, who has been doing business at 185 West Pearl street, Cincinnati, in grinding, buffing, polishing and plating, has associated with him in business Geo. W. Galbraith, under the style of Enderbrock & Co. The firm have added to their business the making of small special machines and machinery, and light machine work generally.

Wells, Fargo & Co. Express have recently opened a Mexican branch, which promises to be of service in making small shipments to that country, as no separate bills of lading or consular invoices are required. By consigning a large number of articles to one consignee, the express company gets the whole through on one invoice subject to a single charge.

O. S. Walker and two others have started the Yankee Machine Works, Evansville, Ind. He writes us: "We are three young men with small capital and much assurance, who are trying to institute a new era of good works in this degenerate locality. Our specialty is general repairing, with the aim of ultimately working into small specialties and machine tools."

Hussey, Howe & Co., Pittsburgh, Pa., have ordered another automatic engine of the Westinghouse Machine Company, for use in their rolling mill. It is of 125 horse-power. They have had in use one of the same size for over a year night and day, which is coupled direct to a 6 inch three-high train of rolls, rolling steel. It makes 340 revolutions, and has been indicated as high as 180 horse-power.

Robert Wetherill & Co., Chester, Pa., are now building for the City of Philadelphia a compound condensing pumping engine of the Corliss pattern, capacity ten million gallons. They have just completed for Gloucester City, N. J., a three-million gallon pumping engine of the same type. They have now in course of construction in their shops sixteen of their regular pattern Corliss steam engines, ranging from 50 to 500 horse-power, and all sold. They are also building boilers for most of these. They are now working 275 men full time, and report prospects good for Fall business.

To run the machinery at the Louisville Exposition nine engines of the most approved pattern are used. They are: One Reynolds-Corliss engine, 600 horse-power; one Porter-Allen, 275 horse-power; one Cummer, 100 horse-power; one Harris-Corliss, 200 horse-power; one Taylor, 100 horse-power; one Westinghouse, 100 horse-power; three Armington & Sims, 400 horse-power; and one Buckeye, 100 horse-power.

The Wetherill Steel Casting Company's new works, now being built at Thurlow, near Chester, Pa., will have, when completed, a 12-ton open hearth steel furnace, and a crucible plant for making solid steel castings from one pound up to ten tons. The works will begin operation about January 1st next, and will probably employ about 100 men. The main building is brick, 95x115 feet, with an adjoining building 66x115.

Grant & Bogert, Flushing, New York, shipped last week one 14″ gib rest lathe, having a new elevating tool-post of forged steel, to the Chillicothe (O.) Sewing Machine Company. They also have a foreign order for one 22″ swing lathe, with 12-foot bed. They have twelve lathes nearly ready for shipment, on order to different parts of the country. They have quite a number of orders ahead, and have just put on an extra force of machinists.

The American Certaldo Marble Company, of Pittsburgh, Pa., are developing a new enterprise. It is the conversion of gypsum into marble under an Italian process. The gypsum is worked by ordinary wood-working tools before treatment. It is susceptible of a high polish, may be tinted any color, and beautifully retains the natural grain of the stone. They are greatly enlarging their facilities, and are putting in a Westinghouse automatic engine of 60 horse-power.

We have received from Geo. Richards & Co., Manchester, England, Sectional Catalogue No. 1 of standard special wood-cutting machines for cheapening the cost of pattern and model-making, as made by them. The machines illustrated are of the American type. Mr. Richards having been engaged in the same business in Philadelphia. It appears from the published list of prominent establishments using these machines in Great Britain that they are quite largely appreciated.

The Allegheny County Light Company, of Pittsburgh, Pa., are doing a prosperous business. They have recently increased their plant, and have added another Westinghouse automatic engine of 125 horse-power. They now have seven of these engines in operation, all of which belt direct to the dynamos on the second floor, without the use of counter-shafting. They also have a small engine of the same make, coupled direct to a six-light dynamo, which is used on a special circuit, and frequently runs for a week at a time without stopping, at 1,000 revolutions.

A new company is about to start in New London, Conn., the manufacture of patent cane umbrellas. At a cost of $6,000 this company has applied for patents in England, France, Belgium, Austria, Germany and Australia, and just as soon as this protection is secured they will begin to turn out their goods at the rate of 2,000 per day, employing in their factory 500 hands—men, women and children. One feature of this industry will be that every part of the work will be done in New London, and all the material used in the manufacture is of native growth or production.—*Boston Commercial Bulletin.*

We have received from Jackson & Tyler, Baltimore, Md., a 148-page illustrated catalogue of machinery, tools and supplies for railways, machinists and mills. In their preface they say they have endeavored to revise and correct the many changes which have taken place during the last three years, as well as to illustrate the new machinery and tools which have been put upon the market during that time. The catalogue is quite creditable. Regular price-lists are given. They are agents for quite a number of prominent manufacturers, and have added to their business the Progress Machine Works, for the manufacture of machine screws and special machinery.

Geo. W. Moyers, of Altamonte, Fla., has devised a very handy rig in his saw mill. He has a pony planer and a lath mill, both of which he desires to run independent of his mill engine. He has, therefore, purchased a 6x6 Westinghouse engine, which he has bolted down to the floor midway between the two tools, and at such a distance from the engine that the same belt may be changed to either machine at will. As it is more convenient to have the two tools run in opposite directions, the engine is made reversible by a simple slip eccentric, so that it will run either way as started. As he wishes to run only one of the machines at a time, it is only necessary to shift the belt to whichever machine is wanted, start the engine by the wheel in the desired direction, and go to work.

Machinists' Supplies and Iron.

NEW YORK, August 30, 1883.

The supply business, while not particularly lively, is in a fair condition, with reasonably good prospects for the future. Novelties are not being brought forward as extensively as they were a few months ago, dealers depending for business on standard articles of manufacture. E. Gould & Eberhardt, Newark, N. J. have issued a new illustrated catalogue, embracing their more recent designs of machine tools. It is neatly gotten up, and gives more particulars of the machines represented than are usually found in trade catalogues—a feature which we think will be appreciated.

In American pig iron the supply is rather in excess of the demand, although there is but little inclination to concede lower prices. We quote: No. 1 X foundry, at $22 to $23, with inferior brands at $21.50. No. 2 X foundry, choice brands, are held at $21, but ordinary lots are sold at $20 to $20.50, with some sales at tide-water at $19.50. Scotch pig is weak, with quotations of Coltness, $23 to $23.50; Glengarnock, $23; Gartsherrie, $23.50; Summerlee, $22.50 to $23; and Eglinton, $21.

Copper, 15c. to 15½c. for Lake; other brands, 14c. to 14½c., with the tendency of prices in buyers' favor.

Antimony—Hallett's, 9c.; Cookson's, 10½c.

Lead is in slight demand, with sales of small jobbing lots at 4.20c. to 4.25c.

Spelter—Common Domestic, 4.50c. to 4.90c.; Refined, 8c. to 8¼c.

Tin is held steadily, at jobbing lots of Banca, 22c.; Straits and Malacca, 21¾c. to 21¾c.

Boiler Plate sells as follows: Tank, 2¼c. to 2¾c.; Refined, 2¾c. to 2 9-10c.; Shell, 3¼c. to 3¾c.; Flange, 4¼c. to 4¾c.; extra Flange and Fire Box, 5¼c. to 5½.; Siemens Steel Plate, 5¼c. to 6c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue

Wanted—Situation as Foreman Blacksmith, best of reference given. Address, P. O. Box, 736, Portsmouth, New Hampshire.

A mechanical engineer, foreigner, and with several years' experience, desires a position as draughtsman. Address, P. O. Box 210, New York City.

Engagement wanted as Superintendent or Draughtsman, accustomed to steam engine, iron works, sugar machinery and general work. Address, J. H., care of AMERICAN MACHINIST.

Foreman wanted in a small shop; repairing, jobbeing, brass-finishing, etc. One having some knowledge of sailing vessels and apparatus used thereon preferred. Address, stating where formerly employed, F. H. P., AMERICAN MACHINIST office.

Wanted—A situation as foreman. A practical man will soon be at liberty to take a position as foreman of machine shop. Good references given. Address, Foreman, care of AMERICAN MACHINIST.

Wanted—Situation as superintendent or foreman. A practical, wide-awake man will be at liberty October 1st, and desires a situation as above. Good references given. Address, Box 2, care AMERICAN MACHINIST.

Wanted—A superintendent for an agricultural implement factory manufacturing mowers, reapers, horse rakes and plows, and employing about 200 hands. We want a man of practical experience, good executive ability and thoroughly competent to take charge of such an establishment. Address giving references and salary expected, Frost & Wood, Smiths Falls, Ontario, Canada.

A gentleman, for many years engaged in commission business in Britain, where he is well localized and having influence, and occasionally undertook business trips to the European Continent in commercial and technical capacity, seeks an agency for a first-class manufacturing firm, corporation, or patentee, with England as a residental center. The subscriber has spent a year and a half in America, and is at present engaged as traveling agent for an American firm. First class city references and reliable valuable testimonials as to ability and character. Address T., Box 10, AMERICAN MACHINIST.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

Wanted—A partner, a practical machinist, with about $1,800 capital. Address, Lock Box 97, Laconia, N. H.

Manufacturing property for sale, 30,000 feet floor space, competing point for four trunk lines railroads, switch from door. Write for terms and description B. W. Payne & Sons, Corning, N. Y.

A CHEAP, PRACTICAL BOOK THAT EVERY MACHINIST OUGHT TO POSSESS.

The second edition of Simpson's Manual of Screw Cutting, complete; illustrated, enlarged and improved. Endorsed by the leading mechanical papers of the United States as being the cheapest, simplest and most complete work ever written on th subject. Cloth covers, 30c. each, or six for $1.50; paper covers, 20c. each, or nine for $1.50; post-paid. A good agent wanted in every shop. Copies may be ordered through any prominent bookseller, or address publisher, W. Simpson, Box 46, E. Boston, Mass.

BOOKS —RELATING TO— Steam Engines, Machinery, Heat, Gas, Electricity, Casting and Founding, &c.

DESCRIPTIVE CATALOGUE, 100 PAGES, 1883, SENT FREE ON APPLICATION.

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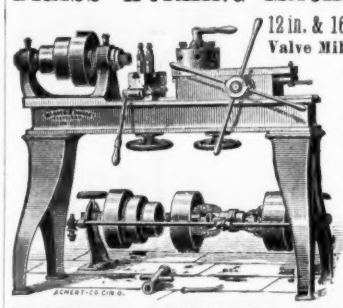

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Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.

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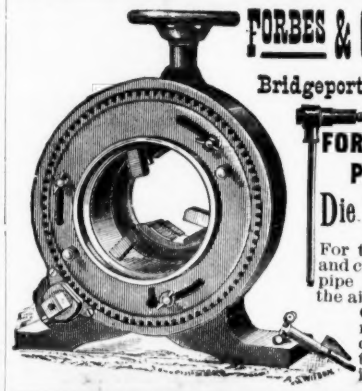

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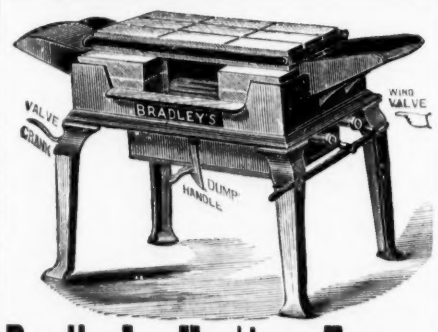
Die Stocks,
For threading and cutting off pipe without the aid of vise. Only one man required to thread 6 in. pipe.



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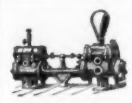

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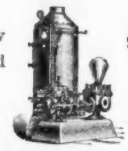

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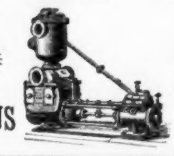

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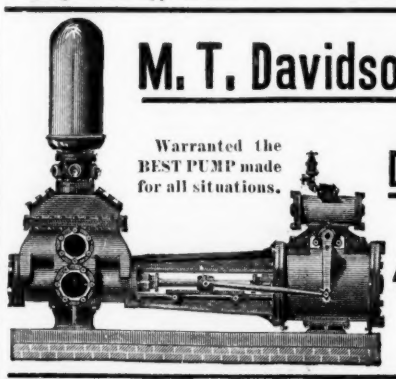

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Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.

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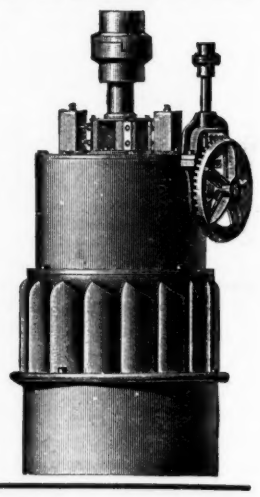

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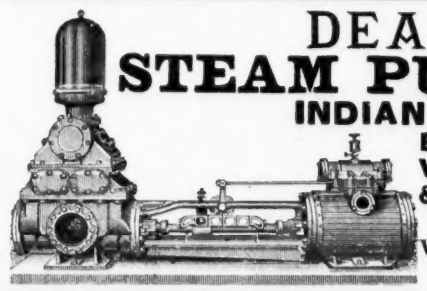

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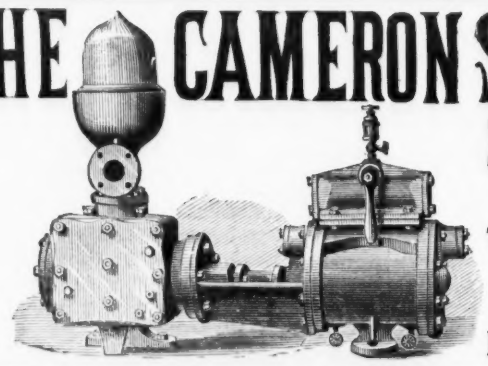

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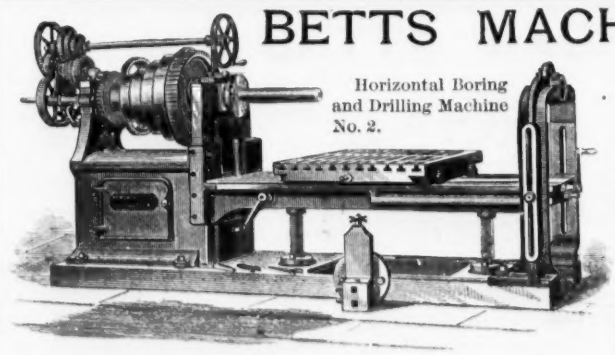

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Gentlemen:—In reply to yours of the 13th inst., asking our opinion of your Nickel-Seated "Pop" Safety Valve, we are pleased to state that it has given our trade general satisfaction. We cannot see how anyone desiring the protection that a "Pop" Valve affords will buy anything but the Nickel-Seated; for the reasou that Pop Valves without the Nickel Seat possessing the same liability to corrosion as the ordinary safety valve have little superiority to claim. In your Nickel-Seated, however, the case is different. We believe it absolutely impossible to make the Nickel Seat stick from corrosion, and if it will not stick it must always be absolutely reliable.

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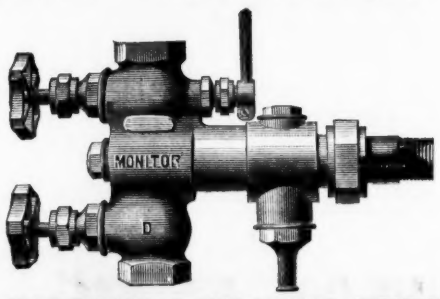

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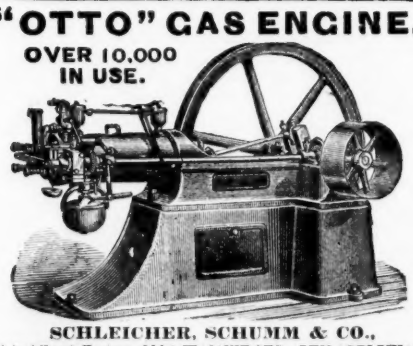

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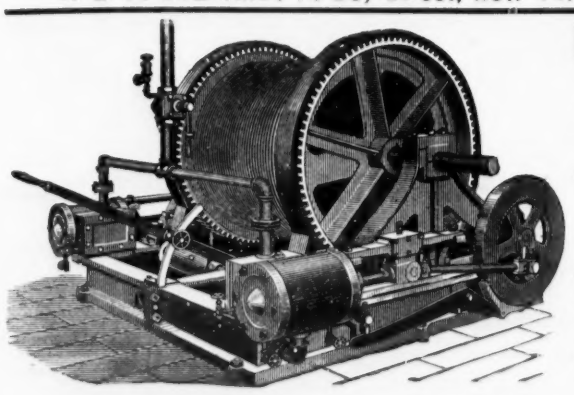

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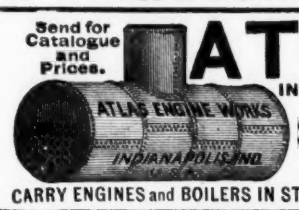

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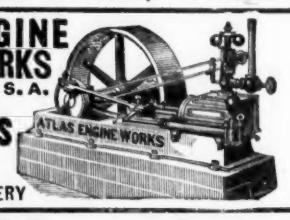

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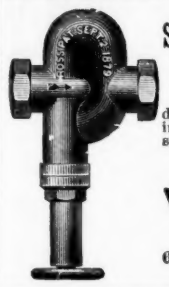

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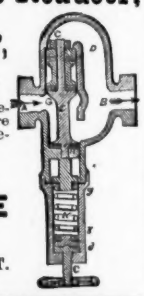

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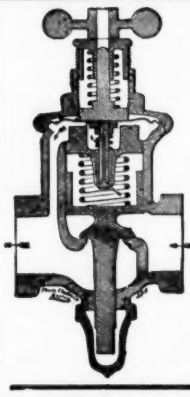

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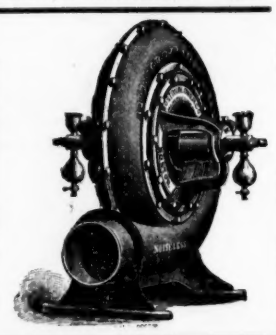

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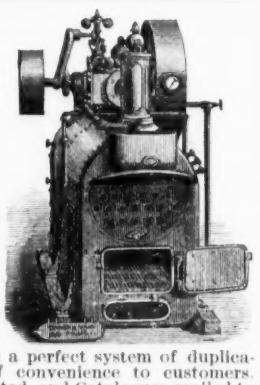

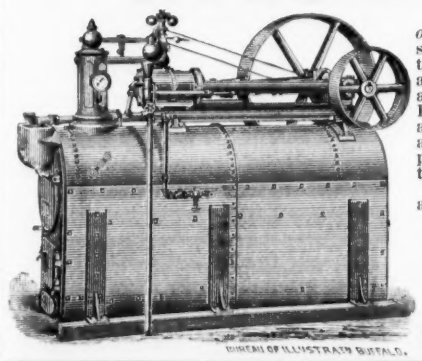

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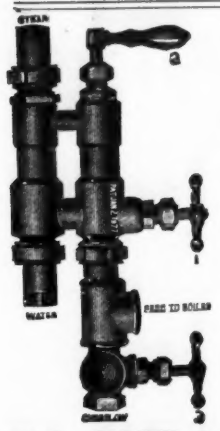

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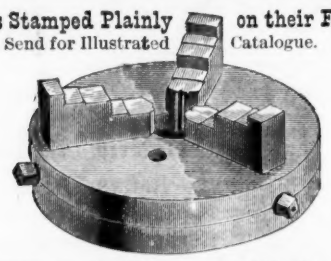

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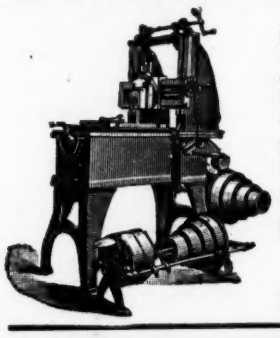

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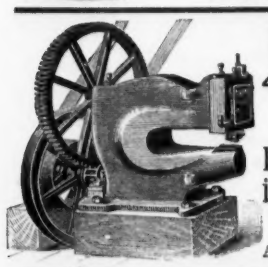

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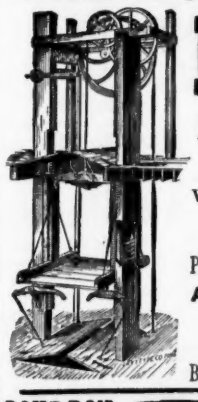

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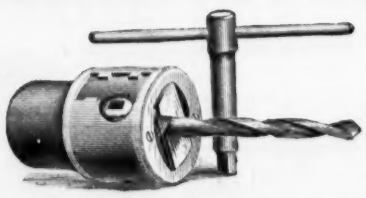

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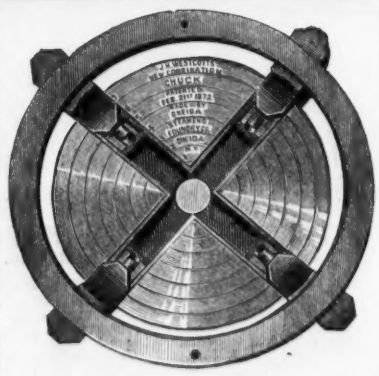

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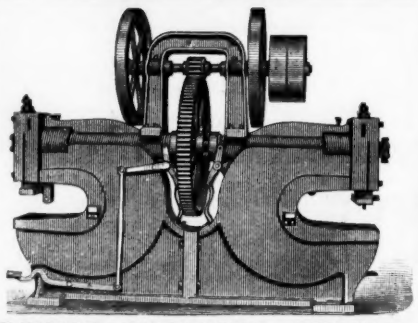

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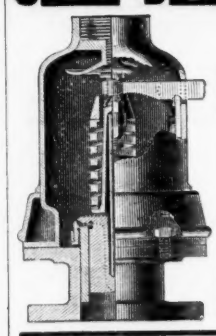

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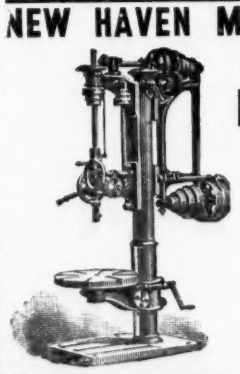

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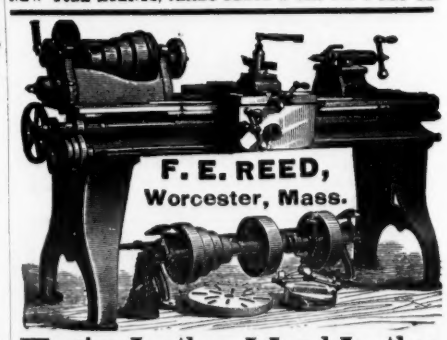

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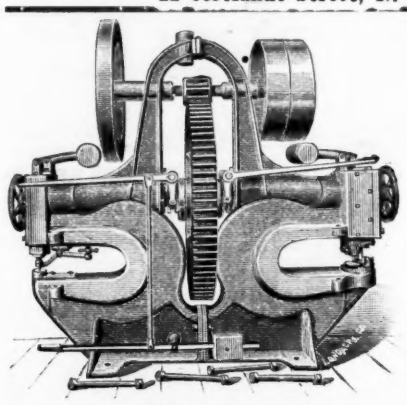

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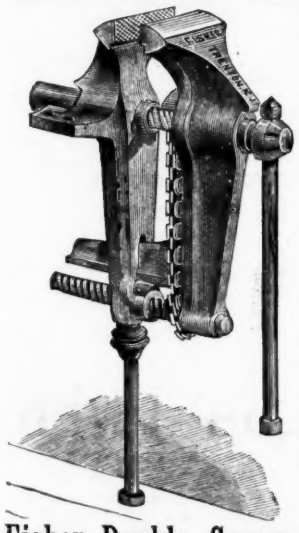

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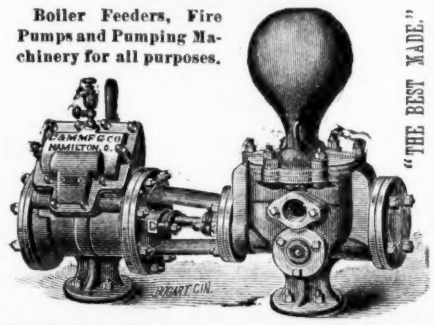

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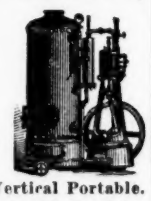

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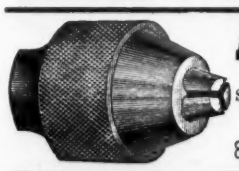

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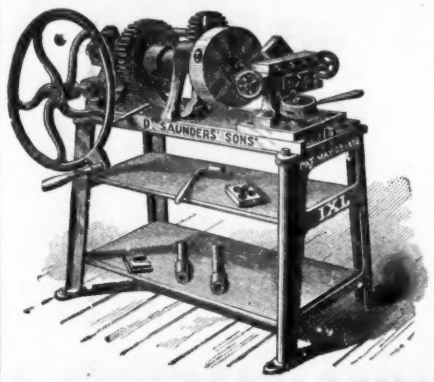

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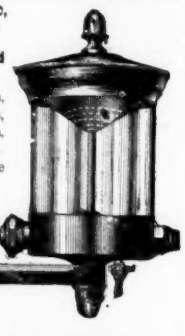

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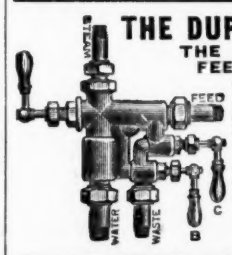

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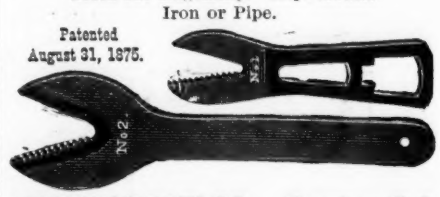

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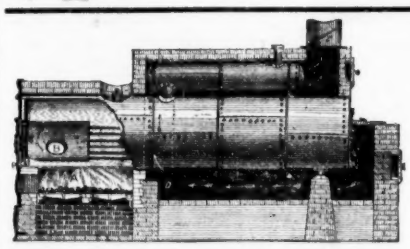

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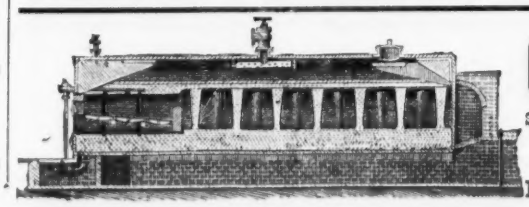

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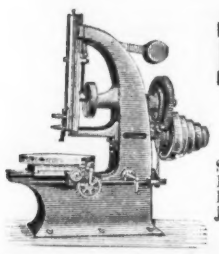

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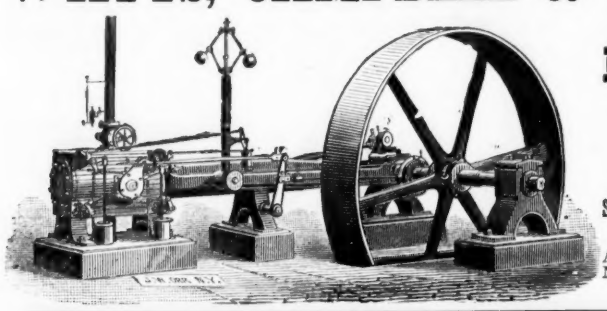

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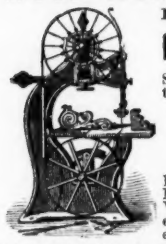

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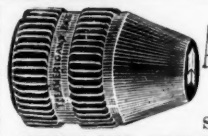

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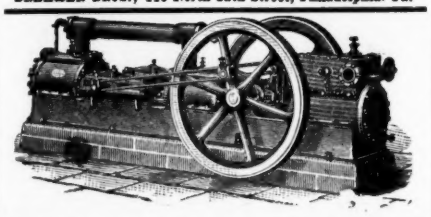

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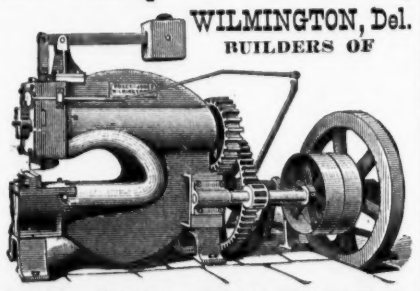

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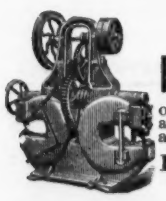

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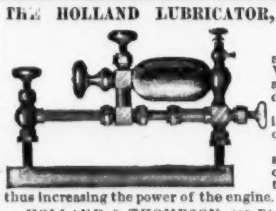

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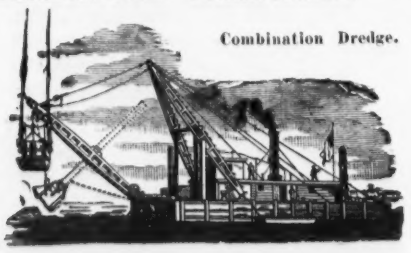

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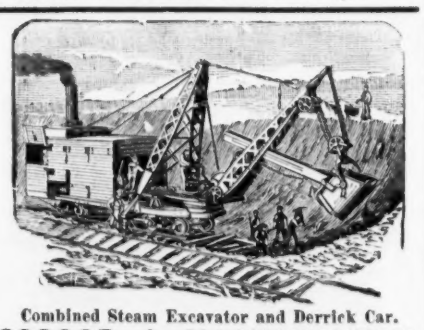

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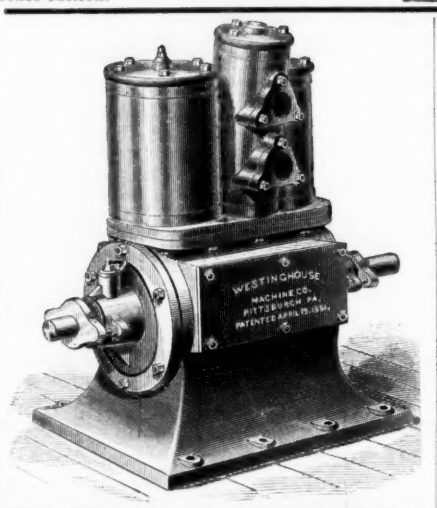

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American Certaldo Marble Co., Pittsburgh, Pa.	65
Mutz & Cassidy, Planing Mill, Ferris, Tex.	50
Blakeman & Dobson, Planing Mill, Rockford, Ill.	50
C. L. Blakeslee, Planing Mill, Schenectady, N. Y.	50
P. M. Brown, Flour Mill, Mill Bridge, N. C.	50
Johnson & Caldwell, Oil Mill, Hillsboro, Tex.	40
W. W. Cloud, Saw Mill, Blythewood, S. C.	40
Utica Match Co., Utica, N. Y.	40
C. C. Ball, Saw Mill, Alexandria, La.	40
Agard & Co., Flour Mill, Rockford, Ill.	40
Cornish & Curtis, Planing Mill, Fort Atkinson, Wis.	40
G. H. Blood, Oil Mill, Pine Bluff, Ark.	30
Henry D. Mentzle, Paper Mill, Ellicott City, Md.	30
C. H. Parmalee, Stamp Mill, Dadeville, Ala.	30
J. W. Bullock Ginning, Calhoun, Ala.	30
Barr & Peterson, Saw Mill, Portland, Oregon.	30
Hudson Lumber Co., Hudson, Wis.	30
B. F. McClenden, Ginning, Alvarado, Tex.	30
Stonewall Mfg. Co., Cotton Mill, Enterprise, Miss.	20
John R. Miller & Co. Hat Manufactory, Reading, Pa	20
Yale & Towne Mfg. Co., Cranes, Stamford, Conn.	20
W. Burgis, Printing, Chicago.	20
S. H. Ferguson, Ginning, Franklin, Tex.	20
H. J. Burton & Co, Elec. Light, Minneapolis, Minn.	20
Niles Paper Mill Co. Niles	20
S. B. Newman, Ginning, Port Sullivan, Tex.	20
J. G. Powledge, Ginning, Aubrey, Tex.	20
C. & H. N. Talley, Ginning, Fairfield, Tex.	12
Indianapolis Malleable Iron Co., Indianapolis, Ind	12
Muhlenburgh & West, Machinists, Reading, Pa.	12
S. F. Haviland, Planing Mill, Calera, Ala.	12
S. R. McCarty, Ginning, Calvert, Tex.	12
W. W. Cook, Ginning, Fort Valley, Ga.	8
G. W. Parsons, Rotary Pump, Salisbury, Md.	8
J. D. Malone, Ginning, Bethel, Tex.	8
John C. Wootten, Philadelphia, Pa.	4
Str. Josie Harry, Electric Light, Memphis, Tenn.	4
Str. Maggie Burke, Electric Light, Mobile, Ala.	4
Noah Mitchell, New York.	4
Jacksonville Gas Co., Jacksonville, Ill.	4
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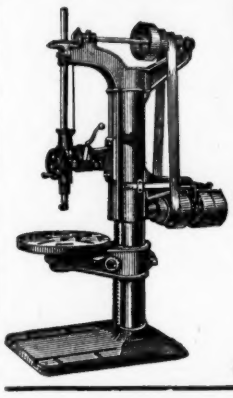

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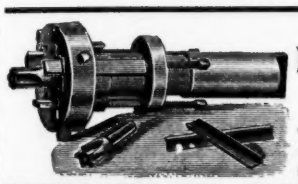

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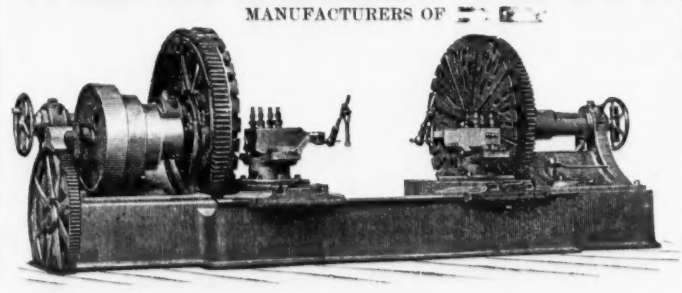

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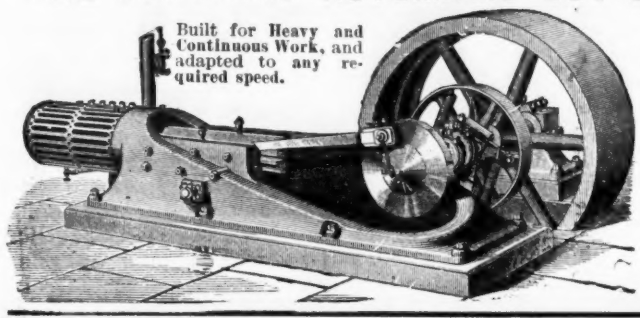

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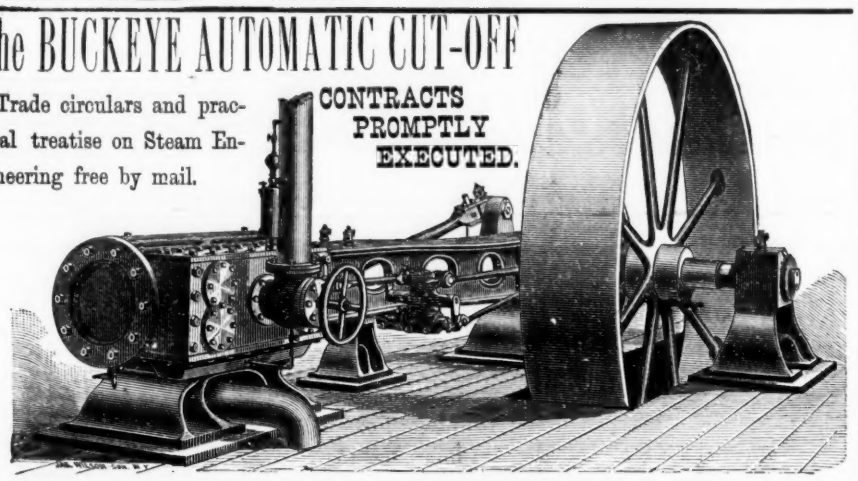

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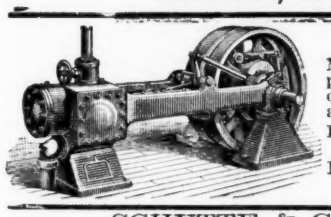

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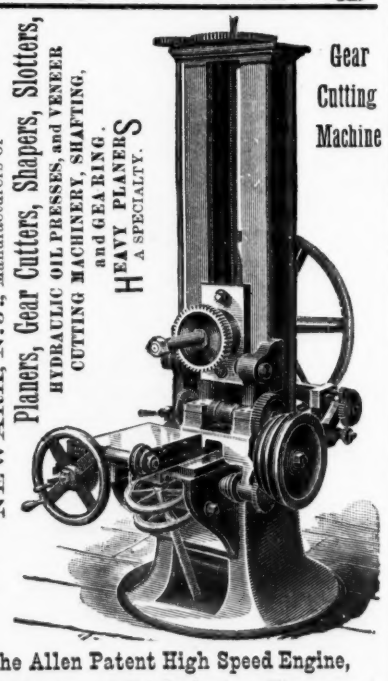

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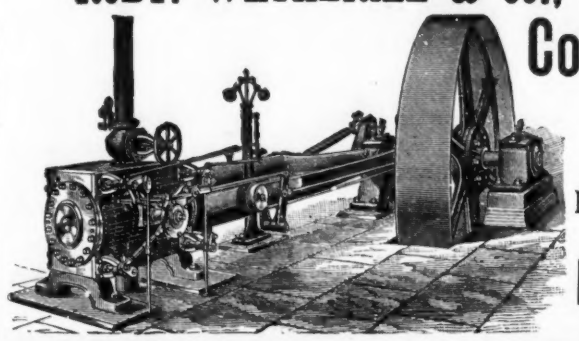

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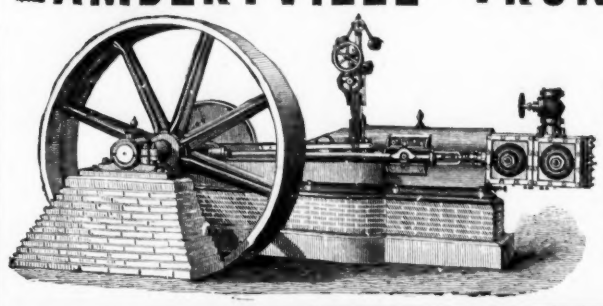

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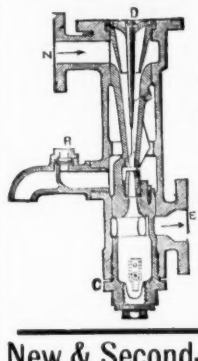

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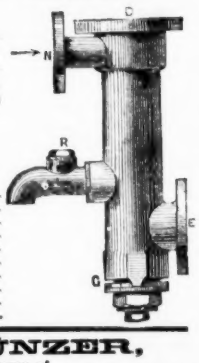

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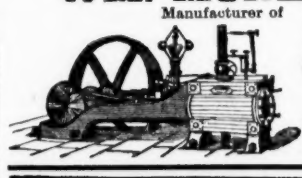

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One " each 6 and 8 feet bed, 16 in. swing.
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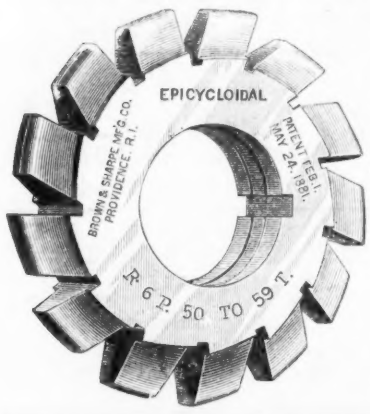
FOR THE TEETH OF GEAR WHEELS,

Which can be Sharpened by Grinding without changing their form.



We are prepared to furnish Cutters of Epicycloidal form, which are sharpened upon the face the same as the Involute Cutters. As gears of this form of teeth to run well must be cut accurately to the proper depth, that the pitch lines may coincide, we make the Cutters with a shoulder (see cut), which determines the exact depth that the gear should be cut; so that care taken in sizing the blanks obviates the necessity of any measurements in cutting the teeth. The Cutters are made for either diametral or circular pitches, and the same rules apply in finding the diameters of blanks as in our system of Involute teeth, (i. e.) 2 pitches added to the diameter at pitch line.

These Cutters will cut gears which are perfectly interchangeable. The white line on edge of the two left hand upper teeth of cut is left for the purpose of placing the Cutter central with work spindle. The Cutters are marked with letters from A to X, by which they may be ordered.

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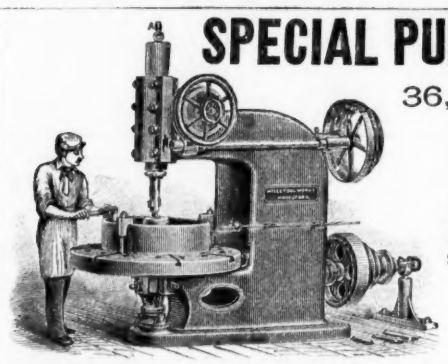

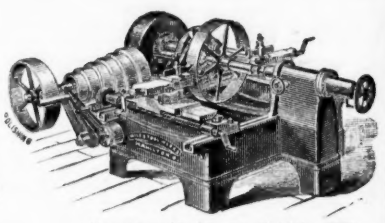

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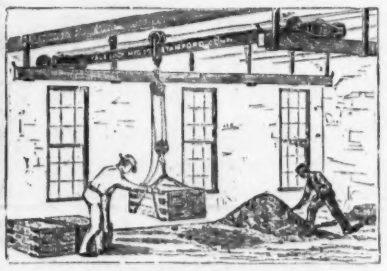

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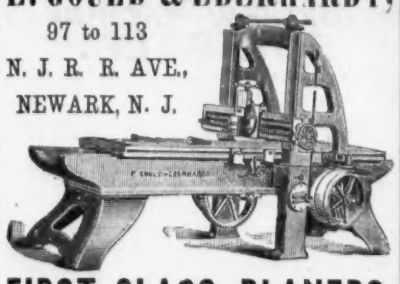

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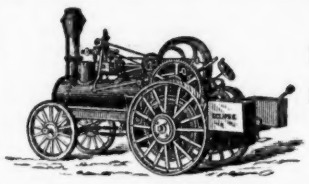

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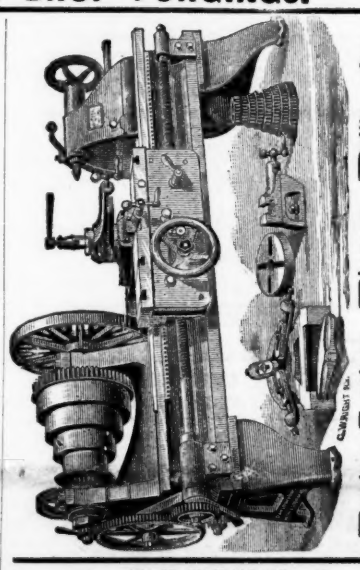

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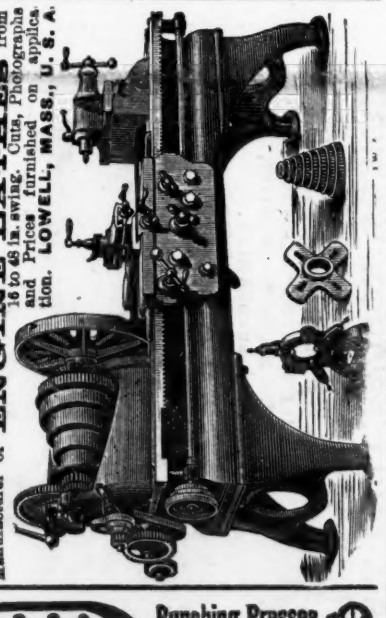

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